

The Royal London
Ophthalmic Hospital Reports,
and Journal of
Ophthalmic Medicine and Surgery.

VOL. VII. PART 1.

FEBRUARY, 1871.

PART I.

Original Contributions.

CASES OF TEMPORARY ANCHYLOBLEPHARON.

(Reported from the Practice of MR. BOWMAN.)

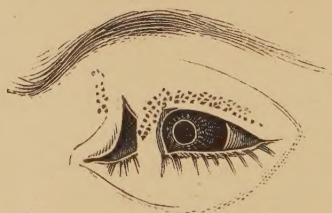
By MR. C. J. WORKMAN.

It is well known that, from the little resistance that the eyelids offer to any contraction of the skin in their neighbourhood during the process of cicatrisation, the upper or lower lid is not unfrequently displaced and its mucous lining everted. This is not only an annoyance to a patient but is also a source of danger to the eye when the ectropion is so severe that the lids cannot be closed. To the surgeon it has been a matter of difficulty to remedy such a deformity. In the first of the cases recorded below, Mr. Bowman conceived the idea that, if after releasing the tissues, he were to unite the upper and lower lids for a time, he would obtain a better effect than by simply performing a plastic operation. The result fully realized his anticipations, as the band of union between the two lids prevented to a great extent the upper one being drawn up again, while the tissues were cicatrising at the site of the plastic operation.

The success of this proceeding has led to its being adopted in another class of cases—that of palsy of the seventh nerve, where the patient is unable to close the eye, which in consequence suffers from constant exposure. Here, too, the result has been very satisfactory.

Amy R—, æt. 17, came to the Royal London Ophthalmic Hospital, in 1863, with a fistulous opening beneath the left eyebrow at the inner side. This Mr. Bowman found was connected with diseased bone, and he succeeded in removing two pieces of the ethmoid bone.

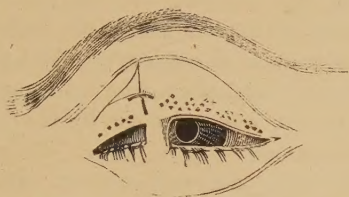
In November, 1865, she came again to the Hospital. The sinus had healed, and the cicatrix had so drawn upon the skin of the upper lid, that the inner third was everted, and the girl was unable to close the eye. Mr. Bowman performed a plastic operation, to release the skin in the neighbourhood of the cicatrix, and united the two lids near the middle of their margins for about $1\frac{1}{2}$ " (Diagram 1).



In November, 1866, she was readmitted into the Hospital. The lids were firmly united by a band of skin, which divided the palpebral fissure into two parts; she was able to open the eye sufficiently to look out of each aperture. The tissues at the site of the old osseous disease were much laxer; another operation was now done, bringing the tarsal margin of the inner upraised one-third portion of the upper eyelid to the level of the outer two-thirds, but the band of adhesion to the lower lid was untouched (Diagram 2).

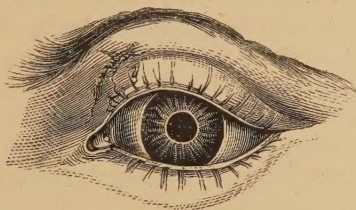
In February, 1867, Mr. Bowman divided the connection between the two lids, and at the same time did a further VY operation, in order to bring the tarsal margin to a lower level.

At the end of April the patient came to show herself; her appearance had much improved, and there had been but very



slight contraction of the tissues, so that on closing the eye there was but a very small chink between the lids.

She was able to read Jaeger 4 with this eye, the cornea of which was slightly nebulous, from an attack of inflammation when she was three years old (Diagram 3).



In December she came into the Hospital for a few days, when it was found that she could close the lids quite as well, if not better than in April, the tissues around not having contracted again since the union between the lids had been divided.

In the following case the cornea had commenced to ulcerate from being constantly exposed, but recovered after the lids were united.

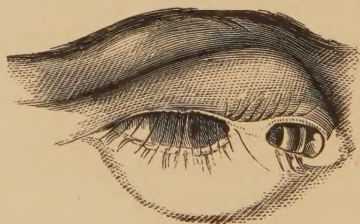
The case has an additional interest, as there can be little doubt but that the optic nerve was divided by the splinter of wood.

Valencia W—, æt. 5, came to the Royal London Ophthalmic Hospital on October 29, 1867, with an orbital abscess following an accident. Her father stated that, a short time before, she fell down, striking the right eyelid against a hoop stick. The child was placed under chloroform, and Mr. Bowman made an incision

beneath the brow; the exciting cause of the abscess was found to be a piece of wood, which had become embedded in the orbit.

In June, 1868, the following was the patient's condition :— There was an unsound cicatrix below the right brow, and the upper lid was drawn up, so that the eye could not be closed. The globe itself was injected and pushed forwards, and a little downwards. On the cornea was an ulcer to the inner side of the pupil, and this was accompanied by onyx. To prevent any more retraction of the upper lid, and also to protect the cornea, Mr. Bowman pared the edges of the lids about the middle, for about an eighth of an inch, and united them by two stitches; before doing this he made an incision along the site of the cicatrix, so as to release the skin a little, and also to examine with a probe whether there was any more wood or dead bone; but nothing was removed.

At the end of June, ten days after the operation, the lids were firmly united, and the upper one already elongated. There was a good deal of discharge from the opening below the brow. April 9th, 1869, she was brought to the Hospital to be seen, before her father and his family went to Chicago. The sinus which had existed had closed some six or eight weeks, but the tissues did not seem thoroughly sound. The lids were united by a band, as seen in Diagram 4.



The child could not perfectly close the eye, but this had recovered as far as the ulcer of the cornea was concerned, a slight opacity being the only trace left. She has never had any perception of light since the accident, and it seems probable that the splinter of wood had divided the optic nerve. With the ophthalmoscope the nerve was seen to be completely atrophied.

Mr. Bowman thought it advisable to postpone the division of

the band, as the cicatrix at the site of the necrosis was not yet sound, and there was a chance that the lid might be displaced again.

The next case is an illustration of the advantage derived from uniting the lids in a case of paralysis of the portio dura, and by this means preserving the eye from irritation during recovery.

In May last Mr. Lawson united the lids in a woman at the Hospital who was suffering from facial palsy and paralysis of the orbicularis. In consequence of not being able to close the eye, it had become inflamed, and caused the patient a good deal of annoyance. In two months' time she had recovered a good deal of power in the orbicularis, though the facial palsy persisted. The general condition of the eye had much improved, and the patient said that the operation had been a great comfort to her. As she could now nearly close the eye herself, Mr. Lawson divided the band of union.

The illustrative woodcuts, Nos. 3 and 4, were kindly made by Mr. Fairlie Clarke.

[Note by Mr. BOWMAN.—In this operation of uniting the eye-lids for a temporary object, care must be taken not to interfere with the subsequent integrity of the tissues at the tarsal margin. If delicately done, it will be found sufficient to shave off a very thin slice of the opposed margins along the line of the Meibomian orifices, not including that of the cilia. Very fine threads should be used, and should extend beyond the bare surfaces, and take a good hold of the edge of the lid, so as not to cut themselves out. They should be removed on the 5th to the 8th day.]

ON LEAD-POISONING AS A CAUSE OF OPTIC NEURITIS.

By JONATHAN HUTCHINSON, F.R.C.S.

THE following cases are of interest as examples of inflammation of the optic nerves induced by lead-poisoning. The fact that lead will sometimes produce amaurosis has long been known, but until the use of the ophthalmoscope we had no knowledge as to the precise manner in which it was brought about. Some authors appear to consider that the defect of sight is usually due to ciliary paralysis, but most admit that occasionally at least it is a true "amaurosis."

Mackenzie writes, "Lead colic is not unfrequently attended by amaurosis, as well as by deafness, vertigo, delirium, epilepsy, and other nervous symptoms," and further, "the purgative plan of curing lead colic is generally successful in removing the amaurosis which sometimes attends it."

Periera, quoting chiefly from Tanquerel des Planches, mentions various cerebral lesions, but says nothing of amaurosis.

Stelwag von Carion writes, "Yet it is certain that lead poisoning may cause true amaurosis. It has been occasionally seen to arise after very severe headache, while other nervous symptoms are wanting, and again disappear (Hirschler), but in other cases it has become permanent (Rau). It is generally developed after repeated attacks of colic, or other symptoms of lead poisoning. It then occasionally occurs quite gradually, and is soon combined with atrophy of the optic nerve, recognised by the ophthalmoscope. More frequently it appears suddenly with other alarming nervous symptoms during an acute attack of lead poisoning, and then generally leads to complete blindness, which may be either temporary or permanent."*

* Translation by Drs. Hackley and Rosse, p. 668.

Mr. Bader briefly states, under the head "Atrophy of Optic Disc," "Gradual loss of vision, extending over months and years is observed in cases of poisoning with lead, arsenic, tobacco, &c." He appears to consider its action analogous to that of tobacco, slow, and resulting in atrophy without preceding inflammation.

Mr. Soelberg Wells writes, "The absorption of lead into the system will produce amaurosis. I have only met with one case in which the loss of sight could be distinctly traced to lead poisoning. This was in a young woman, who a few months ago came under my care at Moorfields. She had been a worker in lead, and had suffered from severe lead poisoning. She was completely blind, and both optic nerves shewed marked symptoms of atrophy consecutive upon optic neuritis. Mr. Hutchinson has mentioned to me that he has seen similar instances." From Mr. Wells's subsequent statements I infer that he has seen other cases not so severe as the one mentioned, and of which "congestion and hyperæmia" were the chief objective symptoms.*

Neither Mr. Power nor Mr. Macnamara mentions the subject, and the French translators and annotators of Mackenzie's work do not add to the original.

CASE I.—*Severe Lead Poisoning—Double Optic Neuritis, with the usual Symptoms.*

The following case I have already published in these reports (see vol. vi, page 55). It will be for the reader's convenience, however, briefly to recapitulate its facts.

* As an instance of the annoying carelessness with which index makers often do their work, it may be mentioned that the word LEAD does not occur in the index in any of the ophthalmic works from which I have quoted, excepting that of Mr. Wells, and that in the latter there are references to "lead on the cornea," and "lead, acetate of;" but, curiously enough, none to *lead as a cause of amaurosis*. You have to look up "*Amblyopia saturnina*" to find the extract which I have given. Authors, in justice to themselves, really ought to look better after those to whom they entrust the making of the indices to their books.

The patient, a young woman, æt. 19, had been in total darkness for nine or ten weeks. She had begun to work in a lead mill two years before, but had not experienced any inconvenience till the last four months. She had had to handle lead, and had never taken any precautions. At the time mentioned she was admitted into the London Hospital for colic and slight paralysis of the extensors of the wrists. She recovered well, and went back to her work, till she began to be very sick and suffered from severe pain in the back of the head, and gradual failure of sight.

Both discs showed the usual conditions of optic neuritis, being covered with lymph. There were also numerous small apoplexies near them.

CASE II.—*Double Optic Neuritis in connection with Lead Poisoning, but without other Symptoms—Constitutional Symptoms of Neuritis ill-marked—Description of the Discs.*

William Argent, æt. 40, has been a house-painter for twenty years past. He is now a pale complexioned man, and around his teeth is a very marked blue line. He asserts, however, that he has never suffered from lead colic, nor from any other illness which he attributed to the paint. In November, 1867, he was laid up for three weeks with "rheumatics," and had swelling of the backs of hands, great toes, and ancles. Often before that he had suffered from rheumatic pains in various parts. His sight has never been quite what it was since this illness. Two or three months ago, however, it failed more decidedly, and he now found that his left eye was much worse than the right. He has for the last few years often suffered from pain in the head, which he considered rheumatic; it appears to have been a frontal neuralgia. At the time his sight was decidedly failing he had not more headache than usual, nor was there much tendency to sickness. During the last two or three months he has, however, almost always had sickness (to vomiting) once or twice a week. This is a symptom quite new to him.

He applied to me first on February 8th, 1869. I found that with his left he could only see to spell out No. 16, and with the right No. 4. The disc of the left was very pale, and of a blue-white, whilst the vessels were much reduced in size, the arteries being so

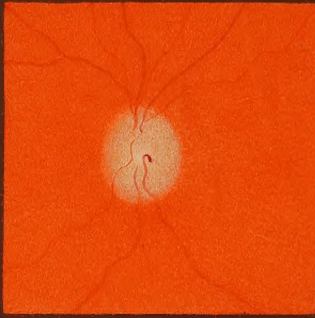


Fig. 1.

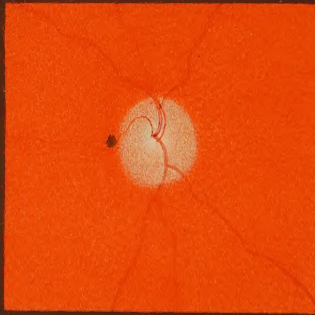


Fig. 2.



Fig. 3.

E. Burgess del ad nat et ch lith.

W. West imp

NEURITIS FROM LEAD-POISONING.

small that they could scarcely be traced. The margins of this disc were quite clear. The disc of the right was white in its nasal (inverted) half, and on the outer part was covered with pale lymph, which concealed its edges. The quantity of lymph, however, was very much less than is usual in many other forms of neuritis. Although headache and sickness have been but slightly marked during the neuritis, yet it is quite certain that they have been present to some extent.

In the left eye the margins of the disc are very definite, not in the least jagged. There is a single minute dot of pigment on the inner side, but with this exception, there is no evidence of disturbance of the choroid. The retina is quite clear at all parts. In the right there is no evidence of choroidal implication. The retina is hazy to a slight extent round the disc, but not to any great distance.

His smell and his tactile sensibility seem perfect.

He has sometimes seen flashes and sparks of light before his eyes.

Reference to Plate.

Figs. 2 and 3, Plate I, show the ophthalmoscopic appearances in the two discs of this case.

Amongst the peculiar ophthalmoscopic features of plumbic neuritis we may mention (a) the small amount of lymph usually present; (b) the absence of colour in the lymph; (c) the absence (not invariable) of extravasations of blood; and (d) the early and great diminution in size of the arteria and vena centralis. The choroid does not appear to be in the least implicated.

CASE III.—Acute Lead Poisoning with Optic Neuritis—Recovery of Health, but with Permanent Blindness.

Mrs. Driscoll, æt. 25, came to us at the Moorfields Hospital, January 7, 1870, having been almost totally blind since an acute attack of lead neuritis four years previously. The evidence she gave us was the following. She went to work four years ago in a lead factory, being at the time in perfect health, and having never before been employed in that way. After six months' employment in the factory she became very ill, had pain in the head, and severe sickness. Her illness was attributed to her work in lead. She was confined at home for a month with these

symptoms, and became at the same time almost blind. The sight failed suddenly and quickly. She had no dropped wrist. When she recovered from her illness the state of her sight was such that she could not return to work. Since that time (4 years) she has never been exposed to the influence of lead, and has enjoyed fair health. Her sight has, however, scarcely improved at all.

State of Vision and Ophthalmoscopic Appearances four Years after the Attack (January 4th, 1870).—She cannot distinguish a gas flame in a dark room, but she asserts that sometimes she can just see light. Both eyes are alike. She is of dark complexion, but pale. With the ophthalmoscope the conditions in the two eyes are found to be exactly alike. The media are quite clear and the fundus is easily seen. In each the disc is quite white. The arteria centralis is diminished to perhaps half its natural size, the veins being much larger. The lesser vessels, which give pink tint to the normal disc, have wholly disappeared. Near to the discs the trunks of the vessels are decidedly obscured, as if from past inflammation, and there are in places white lines along their trunks. (Fig. 3 in Plate.)

CASE IV.—*Hereditary Gout increased by Lead Poisoning—Neuritis of the Left Optic Nerve in 1867 resulting in Permanent Blindness—Neuritis of Right Optic Nerve in 1870 (still under treatment)—Interesting Facts as to Asymmetry of Symptoms.*

John West, æt. 44, a painter by trade, was admitted under Mr. Hutchinson's care at the Royal London Ophthalmic Hospital on September 29, 1870. About three years before this he had been under Mr. Dixon's care for failure of his left eye, when he was told that he had "atrophy of the nerve." This eye became at that time all but blind. He applied on the second occasion on account of the right eye, which had been failing gradually for about three months.

On examination his vision was found to be, for the *right* eye, 20 J. (increased by a convex glass to 7 J.) and $\frac{20}{200}$; with the left he could only see the light. There was contraction of the outer part of the field in the right eye. With the ophthalmoscope it was found that the *right* disc was of a dirty grey colour, its margins "fluffy" and ill-defined, and the large vessels somewhat diminished. The left disc was in a condition of advanced

white atrophy. A blue line was found on his gums, and the gums were much wasted.

The interest of this case lay in the *cause of the neuritis*, and in the occurrence in *the same patient of optic neuritis, lead colic, and gout*. His family and personal history was as follows:—His paternal grandfather was “a martyr to gout;” he was a stout man, a hairdresser, and drank beer. The patient’s father was a plumber, and he also suffered from gout. The patient, a painter, had his first attack of gout sixteen years before admission, in his left great toe; since that time he had had many attacks; the left side seemed to have suffered more severely than the right, and he stated that his left arm and leg had often been rendered quite useless by the gout for a month or two together. His attacks of gout had usually been unsymmetrical; they came on suddenly, and often at night; the affected joints were swollen, shining, red, and painful. He had suffered repeatedly from colic, but never from “wrist-drop.” As to the cause of his attacks of gout, he said that he had never drunk much beer, and but very little spirits; he had always found that an attack of gout came on after he had been “flatting colour.” In “flatting” the work is done in closed rooms, the colour is entirely lead, and is mixed with pure oil of turpentine, a liquid which evaporates quickly, and probably in this way carries off more vapour of lead in a given time than the less volatile liquids used in ordinary painting. He stated that the “flatting” often produces a sort of intoxication, especially in the men who work highest up in the room, and is frequently followed by attacks of colic. He himself had had no colic for five years, and he attributed this exemption to his having worn a moustache during that time.

It is interesting to notice that the eye which failed first was on the side of the body which was earliest and most severely attacked by gout.

One of my most instructive cases in reference to this subject came under my notice at the Newcastle Infirmary, during the visit of the British Medical Association last August. The patient was under Dr. Charlton’s care, and I am indebted to him, not only for permission to examine it, but also to make public use of its facts. Dr. Charlton told me that he had seen several cases of loss of sight from the effects of lead.

CASE V.—*Acute Lead Poisoning, with Imbecility and General Paralysis—Double Optic Neuritis—Complete and Permanent Blindness—Recovery of other Functions under Treatment by Iodide of Potassium.*

Kate Morgan, æt. 19, came to Newcastle in September, 1869, and engaged herself in the lead works. Her occupation consisted in carrying white lead. In about four months she began to suffer from symptoms of poisoning. Her bowels became costive and her muscles weak. Her sight also began to fail, and in five weeks from its first defect she was quite blind. When, in the beginning of May, she was admitted into the infirmary under Dr. Charlton's care, her state was most deplorable. She was wholly blind, unable to speak distinctly, paralysed in all limbs to the extent that she could not use them, and liable to incontinence of both urine and fæces. Her expression was that of an imbecile, and in addition to her defect in vocalisation, there seemed also to be inability to find her words. There was a distinct blue line around the gums.

When I saw her in August, she had been three months under treatment by iodide of potassium and sulphate of magnesia—the former in full doses. She had for six weeks been able to leave her bed, and she could now walk well. Her face had regained an intelligent expression, and she could speak clearly. The incontinence had disappeared. She remained, however, still quite blind. Dr. Page, the house surgeon, who supplied me with the above facts as to her case, kindly procured me also an opportunity for ophthalmoscopic examination. I found the discs both in the same condition of atrophy after neuritis. They were blue white, of a somewhat dirty appearance, and the central vessels had much diminished in size. There were still traces of lymph about the main trunks. At a distance from the discs there were no deviations from the healthy state.

In this case it is evident that the poisoning went very near to a fatal termination.

The girl had probably been very careless in her habits, and had thus obtained an unusual dose of the metal. The result of the treatment was most marked, and most satisfactory. If we ask why the other nerves recovered their functions so much more fully than did those of sight, we shall be obliged to give

a hesitating answer. Possibly the strength of the sheath surrounding the optic nerves renders inflammatory swelling more injurious to them than it is to others. It is possible, however, that the cause of the paralysis of the limbs was a central inflammation rather than a neuritis. As to what had occurred in the eyes, there could be no room for doubt, especially when we compare it with the other cases which I have recorded.

PUNCTURED WOUND OF THE SCLEROTIC, WITH ESCAPE OF
VITREOUS, TREATED BY CLOSING THE WOUND WITH A
SUTURE.

By GEORGE LAWSON, F.R.C.S.,

*Surgeon to the Royal London Ophthalmic Hospital, and Assistant-
Surgeon to the Middlesex Hospital.*

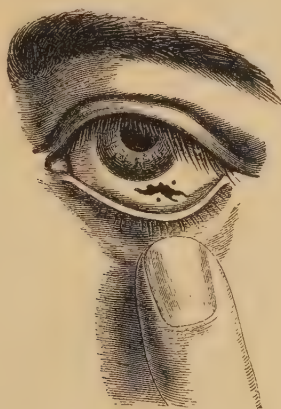
IN punctured wounds of the sclerotic there is frequently a difficulty in obtaining direct or primary union, and this is especially the case if the wound be in the lower region of the eye, and there be a loss of vitreous at the time of the accident.

This occasional apparent incapacity to unite arises solely from mechanical causes, and not from any defect in the reparative powers of the sclerotic coat itself. From the cup-like shape of the sclerotic, and from its peculiar inability to adapt itself rapidly to a diminution of the contents of the globe, there is always a tendency for the lips of a wound in this structure to gape if there be also associated with it an escape of vitreous.

When there is a loss of vitreous from a punctured wound of the sclerotic in the lower region of the eye, the vitreous is very apt by mere gravity to continue to drain through it, and thus to keep the edges of the wound apart, by preventing the eye being again plumped out by an abundant secretion of aqueous. If, however, the wound in the sclerotic be closed by a single fine suture, and the escape of the vitreous be arrested, union of the cut edges will rapidly follow. The suture should be of the finest silk, and to each end of it a small needle should be fastened, so as to allow of the silk being drawn through each edge of the wound separately, and from *within* outwards.

W. G., æt. 40, came under my care at the Royal London Ophthalmic Hospital on March 5th, 1869, having a few hours

previously met with the following accident:—Whilst engaged breaking stones, a fragment of stone flew up, and struck him on the left eye, causing a jagged wound in the sclerotic in the lower part of the eye, at a short distance from the cornea. There had been evidently an escape of a small quantity of vitreous. The wound presented the appearance represented in the woodcut; it was gaping, and its lower edge was prominent, and stood away from the upper margin, which was somewhat depressed. From the man's account it was clear that there was no particle of stone lodged within the eye.



As it was clearly impossible to bring the edges of the wound together without a suture, I introduced a single thread through the points marked in the drawing, and brought the divided parts into apposition. The patient progressed most favourably, and the wound completely united; the presence of the stitch produced no irritation.

On April 27th, this man came to show himself at the hospital. There was no redness of the eye, which seemed to have recovered completely from the accident; but on testing his vision he could only count fingers, and on examination with the ophthalmoscope an extensive detachment of the retina was seen to correspond with the site of the puncture. This was no doubt due to hæmorrhage between the choroid and retina at the time of the injury.

CASE OF SYMPATHETIC RETINITIS PIGMENTOSA.

By D. ARGYLL ROBERTSON, M.D., F.R.C.S., Edin.

THE following case is, I believe, a true example of sympathetic ophthalmia, although the character of the inflammation differs from that which we usually observe resulting from sympathetic irritation; for while this disease is usually characterised by plastic inflammation of the iris, extending back to the ciliary processes and choroid, this had as its chief feature retinal inflammation with pigmentary deposit.

On the 6th of August, 1868, I was consulted by John Haig, a blacksmith, æt. 61, on account of dimness of vision.

He stated that his sight was good till about four years ago, when he received a blow on the *right* eye from a piece of stone. After he had recovered from the inflammation which attended this injury, he found that the sight in that eye was very dim, but was much improved by a cataract glass which he accidentally applied to it. He also noticed that when he stooped a dark body fell across the sight and blinded that eye, but that on looking up vision returned. He further stated that although he could, while looking in front of him, observe objects on the ground, those much above the level of the eye were obscured by a black or red cloud, which he said appeared about as big as a farthing. For several years the sight in his *left* eye has been growing dim, all objects appearing to be obscured by a thick mist. Cataract glasses afforded no improvement to this eye. He was thus compelled to depend for vision upon his right eye, which, when aided by a cataract glass, sufficed to enable him to follow his occupation and even to read moderate sized print.

About 13 months previously he had received a severe blow with a hammer on the right supra-orbital ridge, after which he had severe inflammation in the right eye. He was positive, however, that the hammer did not strike the eye. His sight was very dim after this accident, and four or five months elapsed before it became nearly as clear as it had previously been, but since then the

sight has again become gradually more and more obscured. He now complains of *muscæ volitantes*, and that while he can see pretty well in bright daylight, that in the dusk of evening or early morning he is almost completely blind, and that then he sees better with the left than with the right eye.

On examination of the *right* eye, I found that the plane of the iris was deeper than usual, the pupil balloon-shaped, and drawn to the outer and upper edge of the cornea, where there was a small cicatrix, to which the iris was adherent. The iris was very tremulous, quivering on the least movement of the eye, and the pupil did not act at all, or only very slightly, under the stimulus of light. The tension of the eye was normal.

In the *left* eye there was deep-seated opacity of the lens, involving the posterior capsule. The iris was tremulous, the tension of the eye natural.

With the *right* eye, to which a convex glass of 4 inches focus was applied, the patient was able to read No. 4 of Snellen's types, at from 9 to 12 inches distance.

The pupil of the left eye was dilated, whereby the patient stated his sight was much improved. With it he was able to decipher some of the letters of No. 7 of Snellen's types.

On examining the field of vision, it was found to be markedly contracted in both eyes. The extent of field of vision of the *right* eye at one foot distance was:—

To the outer side, 8 inches.

„ inner „ $2\frac{1}{2}$ „

Downwards $1\frac{1}{2}$ „

Upwards $2\frac{1}{2}$ „

while in the left it measured between 4 and 5 inches in each direction.

On reflecting the light with the ophthalmoscope into the right eye a white body was observed occupying the lower part of the vitreous chamber, and which, on the patient moving the eye upwards, and then downwards, floated up and down in the vitreous humour. This was evidently an opaque dislocated lens. The optic nerve was observed to be slightly atrophied, and the arterial vessels somewhat diminished in calibre. Around the optic entrance there was a large patch of choroidal atrophy of irregular shape, leading upwards to a track of partially atrophied choroid. The periphery of the fundus exhibited all the characters

of retinitis pigmentosa, there being numerous deposits of pigment, chiefly stellate, and most marked in the neighbourhood of the larger branches of the retinal vessels. The retina and choroid appeared healthy in the neighbourhood of the macula lutea.

The ophthalmoscopic examination of the *left* eye was rendered very difficult by the extent of the opacity of the lens, but I was able to detect a degree of atrophy of the choroid, especially at the entrance of the optic nerve, while pigmentary deposit into the retina was very well marked in the equatorial region, especially at the inner side, but not to such an extent as in the other eye.

Some of the symptoms in this case deserve a word of explanation.

The improvement in vision that resulted from the use of a cataract glass indicated that the blow on the right eye had given rise to dislocation of the lens; and the sudden obscuration during stooping was explained by the falling forwards of the opaque lens into its natural position behind the pupil whereby the access of light to the retina was prevented. The lens when lying at the foot of the vitreous humour prevented the rays of light from objects above the horizontal plane from striking the retina, and thus the upper part of the field of vision was darkened. The presence of hemeralopia and the excessive concentric contraction of the field of vision in both eyes at once, led to the suspicion of the existence of retinitis pigmentosa, which ophthalmoscopic examination verified.

From a consideration of the history of the case, I am inclined to adopt the following view with regard to the sequence of the pathological processes and their relation to one another.

The blow from the stone to which he ascribes the origin of all his troubles, must have occasioned a rupture of the suspensory ligament of the lens and dislocation with subsequent opacity of that structure. In its new situation the lens acted as a foreign body, giving rise to irritation of the adjacent structures leading eventually to pigmen-

tary inflammation of the retina. The irritation thus caused did not merely affect the wounded eye, but by sympathy involved the other, inducing there a similar inflammation to that which existed in the injured eye. Further, the opacity of the lens in the left eye may, I think, at any rate in part be viewed as secondary to the inflammation of the retina and choroid, as it presented much of the appearance of that cataract which is caused by defective nutrition, the result of deep-seated disease, more especially atrophy of the choroid.

This I consider the most feasible explanation of the different pathological changes, although, as far as I am aware, no case has been reported in which pigmentary retinitis has been ascribed to any source of irritation, either direct or sympathetic. But it is most natural to conclude that the dislocated lens might in the above case, from some idiosyncrasy, induce this form of inflammation, although we know that in other instances a dislocated lens gives rise to an inflammation of a different character.

Professor von Graefe has recently reported two cases of sympathetic inflammation which bear considerable resemblance to the case I have narrated.

The first occurred in a man aged 35, who from birth had been blind of his left eye, which had only lately become painful, in consequence of the dislocation of a calcareous lens into the anterior chamber. His right eye was sensitive to the light, but otherwise healthy. Von Graefe removed the dislocated lens, and the wound healed thoroughly, but the eye remained irritable and tender to the touch, and eventually plastic inflammation of the ciliary processes and choroid ensued.

Six weeks after the operation the sight of the other eye became suddenly impaired. On ophthalmoscopic examination this impairment was found to be due to simple serous inflammation of the retina. Subsequently the eye became affected with iritis serosa and paralysis of the accommodation. After this had lasted for several weeks the disease subsided, and the sight became almost as perfect as it had been before. This good result von Graefe attributed to abatement in the irritability of

the other eye. Ophthalmoscopic examination now exhibited some slight alterations in the choroidal coat.

In the second case, the patient was 20 years of age, and had been blind of the left eye from childhood. This eye had latterly become painful, and dimness of sight had manifested itself in the right eye. On examination of the left eye the retina was found completely detached from the choroid, and the globe was sensitive to the touch. The right eye was found to be affected with slight serous retinitis; some limited opacity of the vitreous humour, and a few spots of choroidal inflammation about the equator of the globe.

The left eye was enucleated.

Examination of the removed globe revealed detachment of the retina, and a calcareous deposit on the inner surface of the choroid.

The operation was followed by improvement in the sight of the other eye, which, however, was not complete when the case was reported.

These two cases, although agreeing in their main features with the case I have reported, differ from it in respect that the inflammation was of a purely serous character, and unattended with the deposit of pigment in the retina; further, that while in my case the inflammations caused by direct and by sympathetic irritation affected the same texture and induced a similar morbid action, in the others the primary disease differed more or less in character from that secondarily induced.

I have only further to remark that I did not consider any treatment advisable, as the eye primarily diseased was the one with which the patient saw best, and it was very doubtful whether the removal of the one would have materially improved the condition of the other eye. I therefore contented myself with advising that belladonna drops be applied so as to keep the pupil dilated. This gave him sufficient sight to pursue his occupation.

THE TREATMENT OF SÄMISCH'S "ULCUS CORNEÆ SERPENS."

By DR. HERMANN PAGENSTECHER.

A TREATISE, by Sämisch, upon the *Ulcus Corneæ Serpens* and its therapeutic treatment, lately published, has doubtless been received with the greatest interest by all members of the profession. The observations therein contained, but more especially the results obtained by the course of treatment propounded are of importance, great, in proportion to the difficulty with which we have hitherto had to contend in dealing with this malady, so frequently irresistible despite our best healing appliances.

Sämisch designates by the name "*Ulcus Serpens*," that malady which develops itself frequently from injury, but sometimes spontaneously at, or occasionally a short distance from, the centre of the cornea. In the beginning of the malady a grey, generally circular, opacity of the cornea presents itself; in the place of this a loss of substance at first of slight depth, becomes apparent; some portion of the edge of the ulceration now swells, and becomes of a greyish-white colour; it is at the seat of this swelling that the ulceration tends to creep along. Simultaneously with its gradual superficial increase, the ulceration acquires also a gradual increase of depth, until the process terminates in leucoma—when the case is favourable—or in perforation, staphyloma, or anterior phthisis. In the great majority of cases hypopyon occurs. Conjunctival and subconjunctival injection, photophobia and lachrymation always occur in greater or less degree. Iritis always ensues, and occasionally iridocyclitis also.

Ciliary neuralgia occurs; in many cases it is of long continuance and violent, in others it lasts but a few days.

Hence it appears that this is the malady commonly

known as *hypopyium-keratitis*, when there is hypopyon of the anterior chamber, or as *keratitis superficialis ulcerativa*, when no such hypopyon exists.

However unimportant, as a rule, may be the name given to any malady, the adoption of this name "*Ulcus Serpens*" may, from a clinical point of view, be well justified: 1st, because a special mode of treatment is now associated with this name; 2nd, because the word "*serpens*" more directly calls attention to the essential character of the ulcer.

Until very lately the almost universally acknowledged remedies against this malady—atropine, warm fomentation, and the greatest possible repose of the eye by means of the pressure-bandage, were resorted to at the Ophthalmic Hospital of Wiesbaden. In many instances these remedies were attended by favourable results; but unfortunately the percentage of instances in which the course of the disease terminated in leucoma-adherens, in glaucoma, or even in complete atrophy was by no means what might have been desired. Independently of the fact that the wet, warm fomentations, and the pressure-bandage, were in some instances found to act in other respects injuriously, and that these remedies necessarily superinduce much washing and personal inconvenience, it was found sometimes with the best possible precautionary measures, impossible to stay the ulcerating process; and often the march of the disease was unchecked until finally perforation of the cornea with all its evil consequences had ensued.

In presence of such results Hofrath Dr. Pagenstecher resolved upon trying the operation so warmly recommended by Sämisch, the "*keratotomie*" (incision of the cornea). He has performed this operation already in twelve cases.

Assuming this number of examples to be too limited to justify the formation of a final judgment, still the surprising rapidity and certainty with which, almost unex-

ceptionally, the progress of the malady was arrested, warrants the hope on his part that other members of the profession will submit this operation to more extensive trial.

The observations which, in following this system of therapeutics, we have had opportunities of making may, so far as the main point is concerned, be reduced to the following:—

1st. The ulceration on the cornea is arrested in its progress, and retained within its already acquired limits. The clouding of the cornea, so inimical to the sight, is thus reduced to the utmost possible minimum.

2nd. The base of the ulcer is cleansed, and becomes more transparent, and the existing infiltration, limited to one side, disappears totally after a few days. In one instance we noticed this to have taken place at the end of 24 hours, in another at the end of 36 hours.

3rd. Hypopyon, when such existed, or the particles clouding the aqueous humour, were to a very great extent at the time of the operation emptied out, and the absorption of such particles as remained behind, was much accelerated. Hereby one danger, frequently unavoidable under other modes of treatment, is frustrated; the organization of these elements, and the closing of the pupil thereby often occasioned, or its adhesion to the anterior capsule is much diminished.

4th. The irritation of the iris decreases rapidly; and in cases submitted to treatment at an early period a very favourable mydriasis is seen soon to set in.

5th. Ciliary-neuralgia, when present, is completely allayed, if not immediately, within a very few hours.

In performing the operations, Sämisch's directions were strictly followed. A simple incision, made with Graefe's narrow knife, slit the base of the ulcer, and this slit was made to extend, on both sides, beyond the edge of the ulcer into the adjoining healthy texture. The greatest care was taken to place the incision if possible, so that the

slit might not directly intrude upon the field of the pupil's operations.

In none of the cases thus treated did any accident occur during the operation, although twice the aqueous humour was seen to flow very suddenly, as in a stream from the anterior chamber. Twice a slight bleeding was observed to ensue in the anterior chamber; but whether this should be ascribed to newly-formed vessels or to rupture of a vessel in the iris from the sudden diminution of pressure, it was not possible to decide. The water that flowed from the chamber was always more or less clouded, and portions of hypopyon, when any existed, were generally discharged together with particles of fibrous matter. Should the iris immediately after the operation become prolapsed into the wound, it may in general be replaced after a few minutes, by means of a slight friction upon the cornea with the upper or lower eye-lid.

The first result of the operation manifests itself in many cases by an almost instantaneous cessation of the most violent ciliary neuralgia; in other cases this neuralgia seems to become intensified for the space of a quarter or of half an hour, and then to give place to a soothing sensation; sometimes, but seldom, the neuralgia lasts longer and only yields to a repeated evacuation of the aqueous humour.

The after-treatment, in which we swerved but very slightly from Sämisch's directions, consisted in the application of a wet compress, in atropine drops applied at intervals of one or two hours, the application of a pressure bandage during the night, and, what is the most important part of the whole proceeding, in the keeping the wound open, or rather in repeatedly reopening the wound during the following days.

The pressure bandage was in all cases worn without inconvenience, and we think that, independently of the experience that the healing process is facilitated by the

immobility thus produced, we may further justify its application by the fact that the patient is thereby kept from involuntarily rubbing the eye during sleep. This appears to us of especial importance, because after the outflow of the aqueous humour, a prolapse of the iris, injury of the zonula zinnii or hyaloidea might very readily be occasioned. No one who has had accidents of this nature after cataract operations, will consider this to be an exaggerated precautionary measure, although the eye be free from pain.

Very often, in the evening of the same day on which the operation was performed, and immediately before laying on the pressure bandage, we have again evacuated the aqueous humour. This is commonly effected by means of a gentle pressure with the upper or under eye-lid upon one of the edges of the wound; when this pressure fails to produce the desired effect, a probe is used. In very rare cases, when the adhesion has already acquired some solidity, a forcible reopening by means of a silver hook or similar instrument has been resorted to. In not one of the cases that have come under our observation was any increase of the ulceration perceptible on the following day; the ulcer itself in all cases presented a cleaner appearance; the infiltrated edge had in some cases become thinner, and in two cases, after the lapse of 24 and 36 hours respectively, had totally disappeared; hypopyon, when it had previously existed, was no longer perceptible, while at the same time the pupil was more widely dilated. On the following days we have pursued the same course, clearing the chamber of aqueous humour twice or thrice daily, according to circumstances, and at night applying the pressure bandage.

Here the question presents itself, for how long should this treatment be continued? or, what indications should determine the moment for finally closing the wound? Sämisch advises that the treatment be continued until reparation of the ulcer has begun; until no trace of opacity

can be seen at the edge; until no trace of clouding can be found throughout the field of ulceration elsewhere than in the immediate vicinity of the wound. This, he says, will on an average be in the third week. We have not, in general, continued the reopening of the anterior chamber so long as this, partly because we judged that the process would thus be needlessly prolonged; partly—and this was our guiding principle in nearly all cases—because the cessation of the progress of ulceration, and the reparation of the ulcer, seemed to us to set in at an earlier period. Accordingly in some cases we kept the wound open during four days only, in others six or seven days, and in but one case eight days. I would call attention to the fact that in many cases we caused discharge of the aqueous humour twice and even thrice in one day. I must also state that in one case, where we suffered the wound to close on the fifth day, we were, after eight days, in consequence of relapse, obliged to do a new operation. In this operation the new slit was made at a right angle to the old one, and a seven weeks' treatment, the same as that followed in the other cases, ended in a very good result. Sometimes after the closing of the wound, when the symptoms of irritation were abated, we used with much advantage the yellow ointment, and found that this contributed not a little to the clearing of the part of the cornea affected.

The results of this treatment may be summed up as follows. In every case we were able to dismiss the patient with a more or less dense clouding of the cornea (generally of the same superficial extent as that of the ulcer), the scar of the wound being marked by a deeper opacity.

But this cannot be considered very injurious to the sight, as the scar principally lies in a diffuse corneal-opacity well capable of dispersing the light.

Minute reports respecting the duration of the treatment in the hospital would of course exhibit great variety;

naturally this duration must depend upon the nature of the malady, the individuality of the patient, and his temperament. For this reason average numbers are of but little value. All that can be affirmed with certainty is, that the final result is obtained by following this course of treatment in a much shorter time than has ever been attained by the courses heretofore pursued. The results already attained are sufficiently encouraging to induce us to apply the same remedies to future cases; and if by greater experience the certainty of success be, as is very probable, more firmly established, we may look upon this mode of treatment as a very important acquisition, certain to reduce to a very small percentage the cases of total leucoma, and of other sad results.

Besides the twelve cases above alluded to, this operation was resorted to in another case which cannot strictly be classed, according to Sämisch, as one of *ulcus serpens*. In this case we had to deal with two small but somewhat deep sores, partaking rather of the character of deep inflammatory pus-infiltrations. As every remedy usually resorted to against maladies of this class proved ineffectual, and the sore still continued to extend both in surface and in depth, a keratotomy was done, and the result was as favourable as could be expected. I shall presently report this case with all its details, but it may be better first to give as illustrations, the two following cases of *ulcus serpens* in which the reparation of the ulceration took place in a strikingly rapid manner.

CASE I.—George B——, æt. 62 years, shoemaker, presented himself, the first time, on the 27th May, 1870. He states that during ten days he has felt very ill at ease in the left eye. The affection has up to the present moment steadily increased. His chief sufferings consisted of a severe ciliary neuralgia, particularly bad during the night, great photophobia, and constant lachrymation. A circular rather superficial loss of substance of about four mm. diameter is situated a little below the centre of the cornea. The surface is of a greyish hue, the inner margin is

bounded by a bright yellow zone about one mm. in width. The aqueous humour is rather clouded, the iris discoloured, the pupil contracted and sluggish. There is a slight hypopyon at the lower part of the anterior chamber, much conjunctival and subconjunctival injection.

On the same day the base of the ulceration was severed by a linear slit, made with Graefe's narrow knife, of about six mm. in length. This was followed by an escape of aqueous humour, clouded, and interspersed with fibrous matter, and a slight discharge of blood into the anterior chamber.

Ordered: one drop of atropine solution every hour, and moist compress.

Within twenty minutes after the operation the ciliary neuralgia had altogether ceased.

In the evening a second discharge of the aqueous humour, and at night the pressure bandage.

28th May.—Sleep good, ulcer still of the same size, hypopyon has disappeared, but little blood in the anterior chamber. The aqueous humour was three times discharged in the course of this day, in the morning, at noon, and in the evening; moist compress and atropine in the intervals, at night the pressure bandage.

29th May.—The inner yellowish zone has completely disappeared, and the whole place presents a somewhat transparent aspect, although still grey. The edges of the wound are slightly puffed. To-day the aqueous humour was again discharged three times; atropine every two hours. A favourable mydriasis ensued, which set in as soon as the anterior chamber had reformed. Conjunctival and subconjunctival injection considerably abated. At night the pressure bandage.

30th May.—The whole surface of ulceration presents to-day a clearer and more pellucid appearance. By slight pressure on the upper half of the cornea, the aqueous humour escapes from the chamber through a small opening in the centre of the incision. During the day atropine was used every two hours; at night the pressure bandage.

31st May.—To-day the eye-ball, being perfectly free from irritation, the aqueous humour clear, the atropine effect good, and, above all, the wound itself clean, no attempt was made to reopen the anterior chamber.

Ordered: atropine every hour.

3rd June.—Day by day the eye becomes less irritable, the atropine effect proves good, there is total freedom from pain, and the ulcer is healing well. Patient, by his own urgent request, is discharged.

8th June.—The patient again presents himself; the eye is quite quiet. In the cornea is a somewhat whitish but transparent mark, corresponding in size to that of the late ulcer, and in this the wound scar is distinctly visible. Small vascular ramifications proceed from the under margin of the cornea to this discoloration.

Ordered: Ung. rubr.

CASE II.—30th May, 1870.—Friedrich Sch——, æt. 57 years, tailor, from Biebrich, states that during the last week he has very often felt a pricking sensation in the left eye. On May 28th he was attacked by very severe pain in the eye and orbital bones, attended with great photophobia and lachrymation. These symptoms still continue and increase. The examination disclosed a grey opaque spot, situate below the middle of the cornea, rather low down, and tending outwards; it was about 5 mm. in diameter, the outer margin somewhat thickened, and with a light grey infiltration, the aqueous humour clouded, iris discoloured, pupil contracted and sluggish, great conjunctival and subconjunctival injection, no hypopyon.

The patient declined immediate admission into the institution, but the same evening he returned, the ciliary neuralgia having become more violent. It was manifest that in the course of the afternoon the ulcer had increased outwardly; hypopyon of the anterior chamber was now perceptible.

Ordered: atropine, pressure bandage, morphia $\frac{1}{4}$ gr.

May 31st.—Slept badly during the night on account of violent ciliary neuralgia; surface of ulceration somewhat larger, hypopyon almost imperceptible. At noon the base of the ulcer was cut through, and immediately an opaque aqueous humour escaped, spurting forth in a jet. Wet compress, atropine every hour. The pains which in the morning were very violent, ceased almost totally within about twenty minutes after the operation. In the evening the chamber was again cleared of water, and the pressure bandage was then applied.

June 1st.—Slept well during the night, pain completely gone, the iris seems somewhat adherent to the corneal wound. In the

afternoon the ulcer displays a cleaner appearance, and the grey-yellow infiltration on the outer edge of the ulceration has vanished. The anterior chamber was opened with a silver hook, and then by a gentle friction of the upper lid along the cornea the connection between the iris and the wound was removed. Ordered: atropine and moist compress. In the evening the anterior chamber was again opened, and the pressure bandage again applied.

June 2nd.—In the morning the wound was reopened; during the day atropine every two hours. Towards evening a rather sudden attack of a violent ciliary neuralgia occurred, it, however, totally ceased within about ten minutes after a discharge of the aqueous humour.

June 3rd.—The anterior chamber again emptied; the ulcer now presents a perfectly clean appearance, and manifests a tendency to cicatrization; the symptoms of irritation have greatly abated, and a very favourable mydriasis has set in; all further opening of the anterior chamber was therefore abstained from, and the treatment was limited to atropine, and application of the pressure bandage.

The same treatment was repeated during the following days; during these the surface of ulceration had so far cicatrized that on the 8th only a slight opacity was visible in the cornea, the scar of the wound appearing in it like a grey streak.

Ordered: Ung. rubr.

13th.—The patient was discharged, with a corneal opacity, scarcely perceptible save when viewed by means of oblique illumination, of a size corresponding to that of the late ulceration, and through it extends a darker streak, the corneal cicatrice.

CASE III.—Mr. K——— has been for four weeks suffering from disease of the eye. He has been under the care of another practitioner, and was treated by him with atropine, etc.

12th January, 1870.—There are two ulcers, each somewhat larger than a grain of millet, situate a little above and internal to the centre of the cornea. The upper ulcer is deeper and larger than the lower. There is intense ciliary injection, lacrymation, photophobia, and ciliary neuralgia.

Ordered: atropine at two hour intervals; three times daily warm fomentations, each of an hour's duration. In the evening morphia injection, and during the night the pressure bandage.

Under this treatment the ulcers had by the 15th of the month increased a little in size, and had also approached nearer to each other. The other symptoms continued unchanged.

On the 16th even the enlargement of the commissure, in order to lessen the pressure upon the ulcers was found not to have had the desired effect, and so on the 20th the two ulcers were found incorporated into one.

On the 21st the slitting of the base of the ulcer—the keratotomy operation—was performed; atropine was dropped in at hourly intervals, wet compresses, and during the night the pressure bandage were applied. After the operation the pain immediately and entirely ceased.

January 22nd.—Good sleep during the night; the corneal wound reopened.

23rd.—The base of the ulcer was cleaner.

January 26th.—Up to this date the wound was reopened daily, sometimes but once, some days twice, and at the same times aqueous humour was discharged from the chamber; atropine was dropped in at two hours' intervals, and at night the pressure bandage was applied.

On the 28th January the basis of the ulcer had become considerably clearer, and had begun to fill up.

On the 5th of February a good vascular ramification, from the corneal edge toward the ulcer, had manifested itself.

On the 13th the reparation of the ulcer was completed throughout, with the exception of one small spot, where the epithelium was still wanting.

On the 20th the patient was in condition to leave, with a clouding of the cornea corresponding in size to that of the basis of the ulcer; in the centre of this clouding was the scar-mark of the incision. He was accordingly discharged, being able to read No. 3 Jaeger.

ATROPHY OF THE OPTIC NERVE AFTER ERYSIPELAS OF THE FACE (TWO CASES.)

By DR. HERMANN PAGENSTECHER.

I HAVE lately had, in the Ophthalmic Institution at Wiesbaden, an opportunity of observing two cases that claim attention as well by reason of their rarity, as of their rapid and deplorable results. In each case the disease under treatment was declared erysipelas of the face and head; in one case the result of a wound, in the other spontaneous. In the one complete atrophy ensued within the space of fourteen days; in the other incipient atrophy with very great diminution of acuteness of vision was the final result.

Ophthalmic literature, at least so far as my acquaintance with it extends, contains but few analogous reports. In the "Ophthalmoscopische Hand Atlas," of Edward von Jaeger, are reported, for the purpose of elucidating Plate X., fig. 51, and Plate XVI., fig. 75, two cases of disease in which the details bear much resemblance to those of the two cases under consideration. The description there given of the first case leaves no doubt of its being a case of erysipelas, and the symptoms mentioned in the second case scarcely admit of its being classed otherwise. In both cases the vessels extending downwards, exhibited a considerable decrease of volume; and a precisely similar characteristic, accidental possibly, was noticed in one of our cases.

It is not my intention to enter into a long discussion as to the essential origin of this atrophy. That the erysipelatous process has extended into the posterior tissue of the ball of the eye is very likely; whether it operates there simply by pressure, or as in the cases lately published by Busch upon peculiar tumours, by absorption, I shall not express an opinion.

PAGENSTECKER ON ERYSIPELAS, ETC.

CASE I.—Johann F——, æt. 63 years, peasant-farmer, while working in a vineyard, early in the month of April of this year, received an apparently slight hurt on the inner angle of the left eye, from the stroke of a vine branch. The patient continued to see perfectly well with the eye, notwithstanding the hurt. He states expressly that he shut the right eye, and did not perceive any decrease in the power of the left eye, and he continued his work as usual until the evening of the following day. Then there suddenly set in feverish symptoms, accompanied by the formation of a red swelling at the seat of injury, and by pain of the eyelid. This soon spread over the left side of the face, and a portion of the upper part of the head; on the day following the eye was completely closed, so that it could not be seen. The patient further stated that he had slight pain in the ball of the eye, and some little difficulty of moving it. After the lapse of fourteen days, the swelling of the eyelid being over, the patient found that he could see nothing with that eye.

When the patient presented himself, on the 24th May, 1870, at the Ophthalmic Institution, a slight scar was perceptible on the inner angle of the eye, extending to the upper lid; there was also paresis of the levator palpebra superioris. The ball of this eye lay a little deeper in the orbit than that of the right eye; its size and consistency were perfectly normal; it was quite blind.

The ophthalmoscopic examination showed that the refracting media were clear, papilla white and sharp edged, atrophy of the retina-tissue to a very high degree; two thread-like vessels extended downwards, but were lost sight of at a little distance from the papilla; upwards three larger, one an artery, the two others veins, were traceable somewhat farther in the retinal tissue. No traces of preceding inflammatory action existed. The examination of the right eye gave emmetropia $V = \frac{1}{16}$.

CASE II.—Carl D——, æt. 49 years, brewer, was until lately in perfect health, and has enjoyed good sight, both for remote objects and for those near at hand. Latterly he has used spectacles when reading, but he does not know the power or number of the glasses.

Some short time before Easter, this year, he became ill during the night with feverish symptoms, and violent headache. On the following day the face began to swell, to redden, and to be

in pain. The eyes were, as the patient expressed himself, quite shut up with swelling, but not protruded nor painful; he only occasionally had a sort of itching in the eyes. The swelling soon spread over the whole upper part of the head. The malady lasted about three weeks, and the doctor, under whose care he was, called it erysipelas of the head and face. When the patient quitted his bed for the first time at the end of the three weeks, he observed that his sight was very much impaired. His sight has ever since continued in this same condition, at least he has never noticed any further diminution.

May 28th.—The examination of the eyes, made to-day, gave for both: $Hm = \frac{1}{30}$ $V = \frac{1.5}{100}$. With $+\frac{1}{28}$ he with difficulty read No. 12 J., and with $+\frac{1}{10}$, No. 6 J. The refracting media were perfectly clear, the papilla, of both eyes, of a reddish-white colour, and sharply edged; lamina cribrosa perfectly perceptible, vessels few in number, arteries particularly small; no noticeable alteration of the macula lutea, nor perceptible change in the periphery of the retina. There was no circular contraction of the field of sight, but there was a rather sharply bounded and clearly marked field of opacity around the central point of each eye.

A CASE OF AMAUROSIS AFTER ERYSIPELAS.

By JONATHAN HUTCHINSON.

WHILST this number of the journal has been passing through the press, a case has come under my notice which is of much interest in connection with Dr. Pagenstecher's paper on amaurosis following erysipelas of the face.

Mr. Richard Allen is a philanthropist, well-known in Dublin. He went over to Metz to give aid to the war-victims, and whilst so engaged was attacked with erysipelas of the face. His nephew and niece who were with him suffered at the same time from small-pox, of which the niece died, but there is no reason to think that his own illness was complicated with variola. He was attended by Dr. Wyman, an able English physician, who considered the disease to be ordinary erysipelas. The eyelids of both eyes were very much swollen, so that for three or four days they could not be opened; but the erysipelas did not spread much on either scalp or face.

Mr. Allen, who is an elderly man, was slightly delirious for a day or two. He assures me that on the second day of the erysipelas he managed to open first one eye, and then the other, with the express object of ascertaining whether he could see, and that he found that he could see with both. After this the disease increased, and for several days the lids were closed. When next he was able to open them, he found the right eye quite blind. The attack does not appear to have been an unusually severe one, and there is no reason to think that the cellular tissue of the eyeball was specially involved.

Mr. Allen returned to London, and came under my observation exactly six weeks after his illness. He was then in good health, and enjoyed perfect vision with his left eye. His right eye diverged a little, and was totally blind. There was nothing whatever abnormal in its appearance, and he could move it well in all directions. Its pupil was small, and although it could be made to act moderately in sympathy with the other, it did not

move in the least when the other eye was kept shut. It dilated fairly with atropine. The media were quite clear. The optic disc showed no traces of inflammation, but was everywhere pale, and especially so on the side next the yellow spot, where the pallor amounted to whiteness.

The branches of the arteria centralis were very much diminished in size, whilst those of the vein were normal. The retina was not in the least clouded.

The facts of this case are remarkably similar to those of Case 1 in Dr. Pagenstecher's paper, the chief difference between the two being the less advanced stage of atrophy in mine. There had been no injury to the head, and it is difficult to offer any explanation of the connection between the erysipelas and the blindness. I have seen several other cases in which an eye has been left blind after an attack of erysipelas of the face, but in most I think there was reason to believe that the erysipelas had been more severe, and had affected the cellular tissue of the orbit more definitely. We must not, however, forget the source of fallacy, that it is still just possible that the eyes in these cases may have been blind before the attack. I have mentioned the evidence which my patient gave on this point, and Dr. Pagenstecher states in his case a similar fact. In neither, however, can it be considered absolutely conclusive, and we must wait the record of other cases before we consider it definitely proved that erysipelas of the face can cause blindness. I may just add that the suspicion crossed my mind that Mr. Allen's case might be one of embolism, and that on examination of his heart I could discover no valvular disease.

MISCELLANEOUS CASES AND OBSERVATIONS.

By JONATHAN HUTCHINSON, F.R.C.S.

(Continued from vol. vi, page 283.)

No. LIX.—*Albinism (incomplete). Divergence and Oscillation of Globes.*

Emma Pidduck, an infant, is a perfect albino, with the exception of eyebrows, eyelashes, and iris, in all of which a slight share of pigment is present. The irides are grey, but with patches of brown pigment in streaks in them. The fire red of the fundus is easily seen when the eyes are turned obliquely. The globes diverge and oscillate.

No. LX.—*Albinism in a Brother and Sister. Defective Vision and Oscillation of Globes in both. Hypermetropia.*

A gentleman from near Spalding, Lincolnshire, consulted me on account of imperfect sight, depending upon albinism. He was 24 years of age, but his perfectly white hair, eyebrows, and whiskers, taken with his florid cheeks, gave him the appearance of a very healthy old man. His albinism was perfect, there being no trace of colour in his hair, skin, or irides. The skin was simply very fair and florid, the entire absence of pigment leaving the capillaries more distinctly visible than in the normal state. He enjoyed good health. One of his sisters was, he said, in a similar condition, but with these exceptions, albinism had been never known before in his family. His sister, who is an albino, was a twin, and her twin-sister is not affected. His father is not very fair, but his mother is so, though still not to an extreme degree. All the children are fair, excepting the youngest, who is like their father, rather dark.

His albino-sister suffers as much inconvenience from her eyes as he does, and is obliged to stay almost wholly at home. His eyes twitch about very much; the movements being chiefly lateral. He has divergent strabismus, the right eye passing outwards. The degree of strabismus varies every moment.

He is not sensible of the twitching, and sees objects quite steadily. He seems to see equally well with either eye, and at 10' reads 100 with $+ 4\frac{1}{2}$; he sees 50 at the same distance. Without glasses he holds the page close, and at 2" puzzles out No. 8; whilst with $+ 4\frac{1}{2}$ he reads No. 8 at 5", and can even read slowly No. 4. He has hitherto been using $+ 14$, but with of course very little advantage.

No. LXI.—*Artificial Eyes worn by Young Children.*

A child æt. only 3 years, whose eye I removed on account of a wound, is now wearing a glass eye perfectly well. I have also under care in private another patient of about the same age, who also wears an artificial eye without any inconvenience. In a third case, still younger, no accident has happened. I feel convinced that artificial eyes might be given much earlier than is usually done with much advantage, especially where the cost is a matter of no importance to the parent. The effect of a conspicuous deformity upon a child's moral tone is often very injurious. A blind and blemished eye often subjects a child to great unhappiness, especially if he be of a timid and sensitive disposition.

No. LXII.—*Failure of Sight during Lactation, and its meaning as a symptom.*

When patients complain of defects of sight during suckling, it is very frequently merely an indication of hypermetropia. Many hypermetropic women experience no inconvenience whatever, excepting when weakened by lactation. Under such circumstances, they find it difficult to keep the ciliary muscle up to its unusual exertion. The difficulty of sight recurs over and over again during successive periods of lactation. These cases must be carefully distinguished from those of retinal disease, which are met with now and then after pregnancy. The use of tonics is indicated at the time, and it is well to examine as to whether spectacles are not requisite. In some cases this defect occurs in emmetropic eyes, and is induced by a form of paresis of the ciliary muscle analogous to what occurs in diphtheria.

No. LXIII.—*Loss of Accommodation from Nervous Shock.*

Temporary failure of sight when nervous, is very often an indication of hypermetropia. A patient may enjoy perfect sight under all other conditions, but be liable to lose distinct vision whenever startled. An example of this was supplied by a young woman who applied at the Ophthalmic Hospital a few weeks ago. She stated that she was very nervous, and that whenever anything occurred to startle her, she lost her sight for near objects. In particular, she mentioned that if in using the sewing-machine her needle snapped, she would be quite unable for a while to see her work. On examination, it was found that she was the subject of latent hypermetropia. An important distinction is to be drawn between a sudden failure of sight from this cause, and from "epilepsy of the retina," in that the former occasions dim vision only, not absolute blindness. As I have just remarked respecting the failure of accommodation, so common during lactation, that it may sometimes happen in emmetropic eyes, so I must admit that the temporary failures from "shock" do not necessarily imply hypermetropia.

No. LXIV.—*Pyramidal Cataract after Purulent Ophthalmia, but in one Eye only.*

William Henry Lincoln, æt. 10, is the subject of a pyramidal cataract in the right eye only. In the same eye there is a central opacity of the cornea. There was a single tag of adhesion between the iris and the cornea. In the left eye there was no cataract, and no corneal opacity. There was a history of severe purulent ophthalmia in infancy, affecting both eyes. Both eyes now oscillate and the right diverges.

I mention this fact as an addition to my report on this subject in Vol. VI, page 140. It is rare to find a pyramidal cataract in one eye only, and when such is the case, there is almost always evidence of corneal ulceration and of iritis.

No. LXV.—*Myosis and Irido-plegia from Brain Disease. Autopsy.*

Mrs. R., æt. 50, was admitted on the 20th February, 1868, on account of double vision. Both pupils were contracted and quite motionless. She could read No. 18 (J.). There was di-

vergent strabismus. No changes were discovered by the ophthalmoscope. During March she suffered very severe pain in the left side of the lower jaw, and towards the end of the month the skin supplied by the left mental nerve became quite numb. In the beginning of May she died, and the following particulars were kindly supplied by the surgeon who attended her.

Her alarming symptoms commenced only two hours before her death, and seemed to indicate chiefly failure of the circulation. She was not insensible, but her surface was cold and clammy.

At the *post mortem* the brain was found much softened on the surface of the middle lobe. The hemispheres themselves were firm in structure. The heart was not examined.

Although the *post mortem* notes are vague, yet the case is of some interest in reference to the fixity of the pupils and defect of vision without neuritis.

No. LXVI.—*On the occasionally intractable Character of Pustular Ophthalmia.*

A pustular ophthalmia is sometimes very intractable. The prognosis may be helped by observing the exact position of the pustules. Those which occur on the conjunctiva at a little distance from the corneal edge are, as a rule, easily cured by the use of mineral astringents, but those which occur on the cornea itself often degenerate into ulcers, and are exceedingly difficult to heal. Another rule of prognosis may be given, that whenever the pustules are found only at the sides of the cornea, that is on the parts exposed with the eyes open, they are more easily cured than when found on the upper or lower parts or when they make a complete circle. The following is a good case in illustration of the occasional severity of "pustular ophthalmia."

A boy, æt. 10, pale, but not specially unhealthy, was admitted on the 13th of January. His left eye only was affected, and a circle of phlyctenulæ, or minute pustules, completely surrounded the cornea, being placed on its outermost edge. The conjunctiva was much congested, but the middle of the cornea was perfectly clear, and there was not much intolerance of light.

The congestion of the conjunctiva was general, and its swelling was such as to occasion slight chemosis. The pupil acted well, and no pain was caused by sudden exposure. The ophthalmia was of one week's duration, but there was a history that in the previous year the same eye had been inflamed. The eye presented the conditions of phlyctenular ophthalmia in such a marked form, that it was thought worth while to have a sketch taken. It was expected at the time that the disease would soon be cured. Respecting the phlyctenulæ, it was noted that they occurred as minute round spots, grey on their surfaces, decidedly raised, but not containing any appreciable quantity of fluid. Not far from the centre of the cornea was a very minute opacity, which might easily have been overlooked, and which was possibly the result of a former attack. The boy was taken into the hospital, and nitrate of silver drops, two grains to the ounce, were used. No benefit, however, was obtained. The whole cornea subsequently became affected, and the other eye was also attacked by a similar disease. The case proved most intractable under all remedies, and the boy was under care for ten months, and recovered with extensive superficial opacities of the cornea. When he was at the worst, his face and scalp were covered with a pustular eruption, his eyelids much swollen, and he had intense intolerance of light. Neither counter-irritation nor topical applications did much for him. Amongst the latter calomel dusted into the eyes was employed without any good result. During his illness the boy became very pale and cachectic.

No. LXVII.—*Pyramidal Cataract in one Eye only, with Corneal Opacity.*

A boy, æt. 9. At the age of one week he had severe purulent ophthalmia, which was worse in the right eye than in the left.

When he came under me, he could see to read but only very slowly. He was hypermetropic; there was twitching of the globes.

On examination, a pyramidal cataract was found in the right eye, touching the cornea, and there was a limited central opacity. The rest of the lens was clear.

(See, also, No. 64, page 39, and my report in Vol. VI).

No. LXVIII.—*Mydriasis and Cataract in Infancy in connection with Syphilis. Subsequent Dislocation of the Lens into the Vitreous. Excision of the Globe.*

The following case is of interest as an example of destructive inflammation of one eye (choroiditis, &c.) from inherited syphilis. The patient, a healthy looking girl, æt. 12, came under treatment in June, 1869, on account of recent inflammation in the right cornea, and with the statement that her left eye had been blind from infancy. Her right cornea was in the early stage of syphilitic keratitis. Her left cornea was perfectly clear, and the pupil being widely dilated there was visible, deep in the pupil, a dense yellow mass. This mass at first sight looked like a new growth, but on more careful inspection, the outline of a displaced opaque lens embedded in lymph could be made out. The diagnosis as to syphilis, and the facts of the infantile history, were helped by some memoranda of Mr. Dixon's on her hospital paper. Under date Nov. 24, 1856, when the child was a few week's old, Mr. Dixon noted, "left pupil largely dilated and fixed, lens hazy, vessels of retina cannot be seen by the ophthalmoscope. Eye said to have looked quite healthy at time of birth." The child's mother added that the first change noticed was enlargement of the pupil, and that the whiteness of the cataract was not observed till a week or two later. In January the child had an eruption and snuffles, and Mr. Dixon prescribed grey powder, which was continued for some months. The child remained under care about a year, at the end of which time the lens was quite opaque, but still in place. The date of its dislocation was not known. After recovery from the infantile symptoms, the child regained good health, and the eye was quite quiet. As already stated, she now came under care on account of the other eye, in which interstitial keratitis was beginning. As the lost eye had been somewhat irritable, and as it was absolutely blind, Mr. Hutchinson advised its removal. The lens was found imbedded in a dense fibrous structure in the outer part of the fundus, the retina and choroid being adherent and completely disorganised.

The attack of keratitis in the left eye ran the usual course of that disease, and was well in about six months.

No. LXIX.—*Acute abscess in the Lachrymal Gland. Good recovery after Incision.*

William Tait, æt. 8, on admission was found to have sore throat and swollen glands in the neck, and complained of pain in both ears. The symptoms had commenced on the Sunday, and on the Friday following the left eyelids swelled.

He was admitted February 16 with a large painful swelling in the region of the left lachrymal gland.

On the 19th the abscess was opened. It continued to discharge for about a fortnight and then healed.

No. LXX.—*Retinitis Pigmentosa.—Chronic Rheumatic Arthritis.*

Jane Grouse, æt. 45, applied November 5, 1868, being then all but blind from the effects of retinitis pigmentosa. Both eyes presented splendid examples of the advanced stage of this disease.

The symptoms had been gradually increasing from childhood.

There was no history of liability to eye disease in her family. She was very ill, and many of her joints were stiffened by chronic rheumatism. She attended only once, and is probably now dead.

No. LXXI.—*Case of Congenital Cataracts, with Myopia and Deafness.*

William H., æt. 22, came under my care in 1865, with symmetrical congenital cataracts. His eyeballs were large and prominent, his cornea being remarkably wide. He was extremely deaf. The cataracts were not complete, but were sufficient to prevent his reading. He was known to have been short-sighted before they appeared. The lenses were removed by needle operations with success. He came up from the country again four years later (in 1869), and was then with + 3½ able to read 1 J. easily. The case is of interest on account of the occurrence of cataract in connection with mal-formed globes and with deafness.

No. LXXII.—*Symmetrical Ptosis in a Child after Purulent Ophthalmia. Operation.*

A boy, æt. 5, was brought in April, 1868, with symmetrical

drooping of the upper eyelids. He could not lift either of them beyond a very little, and had a very narrow palpebral fissure. He was accustomed to hold his face constantly directed upwards in order to look forwards. There was no other defect of the ocular muscles, and his sight was perfect. The history given was that this condition followed a severe attack of purulent ophthalmia in infancy. His mother stated that he had been "blind" for a month after birth. I removed elliptical folds of skin from each upper eyelid, and with the result of obtaining very considerable advantage.

No. LXXIII.—*Case of Extreme Myopia.*

Mary Scott, single, æt. 40, applied at the Ophthalmic Hospital in June, 1868. She was aware that she had been short sighted from childhood, and that her defect had been gradually increasing. She had never used spectacles. With her right eye she read 1 J. easily at 3", and with the left she could accomplish the same, though with some difficulty. She could not vary the distance of the page more than half an inch. With — 2 she read 70 at 20'. There were large crescents in both eyes, and in the right the choroid was absorbed near the yellow spot.

No. LXXIV.—*Neuro-retinitis in connection with Albuminuria and Disease of the Heart.*

I saw Mrs. A. in consultation with Mr. Chinery at Lymington, Hants. She was a lady of dark complexion, æt. 40, married. She had enjoyed good health until six months before I saw her, when she became the subject of sick headaches of extreme severity. From these, for several weeks she was scarcely ever free. She lost her flesh, and became pale, but no œdema of any part was observed. Two months before I saw her, she suddenly found that she could not thread her needle, and after this her sight rapidly failed, until she could only see large inch capitals. Both eyes were exactly alike. She had no pain in the eyeballs, no photopsiæ, no muscæ; simply a mist before them. At the time the eyes began to fail, she was quite free from sick headaches. At the time of my seeing her (Christmas, 1864) her pupils were of moderate size and active. Both optic discs were

covered with lymph, and there were also large white patches in the adjacent retina, with also some apoplexies. Her heart was hypertrophied, and there was valvular disease. I suggested that the urine should be examined, and Mr. Chinery afterwards reported to me that it was loaded with albumen. Mrs. A. died about a month after my visit, but no *post mortem* was obtained.

No. LXXV.—*Atrophy of Left Optic Disc, and Deafness on the same side, after a severe Blow on the Head, which was attended for a time with Hemiplegia.*

Jeremiah S., æt. 68, came under care at Moorfields on account of an acute ulcer on the right cornea. The interest of the case, however, was in connection with the other eye.

The *left* eye was nearly blind; with it he could not count fingers, could only just see one's hand. The pupil dilated well. There was slight opacity in the lens, but with this exception, the media were clear, and the fundus could be easily inspected. The disc was of blue whiteness and very conspicuous; it was somewhat depressed and shelving. The vena and arteria centralis were both considerably diminished in size, the latter being very small; they were both seen with beautiful distinctness.

The choroid around the margin of the disc was absorbed and presented a very definite rim, somewhat jagged and of unequal width at different parts. There was nothing abnormal in the retina or choroid at other parts. There was no albumen in his urine.

His statement was, that twelve or fourteen years ago, whilst in Australia, a tree had, one night, fallen on to his tent and struck his head. It was about ten days before he was able to go about again. His left ear became absolutely deaf from the time of the accident, and was in the same condition when he came under my observation. His left arm and leg were much weakened for a long time after the accident; they subsequently quite recovered, excepting that he was, when seen at the Ophthalmic Hospital, still subject to a little occasional spasm in the leg.

No. LXXVI.—*Hereditary Syphilis; severe Ulcerations since Childhood; Characteristic Teeth; Keratitis; rapid Improvement under Iodide of Potassium.*

Lizzie I., Irish, æt. 26, married four months and pregnant, well grown, applied at the Hospital for Diseases of the Skin on account of tubercular and ulcerating patches on her face. Then there were three patches, one on the forehead, and two on the chin.

On further examination, it was found that there were numerous large scars left by former ulcerations on both legs below the knees, both forearms, on the chest, and on the neck. On the right forearm just above the wrist, all the soft structures had been destroyed, and a thin scar adhered to the bones. The scars were very soft, supple, and pale, and the healed parts were perfectly sound. On the front of each tibia there was some ill-defined periosteal thickening. Her upper central incisor teeth were characteristically dwarfed and notched.

Both cornea were hazy from past keratitis. There was nothing very noticeable about her physiognomy. She suffered much from pain in the head, and there were several deep scars on the scalp. She had a troublesome cough, and had spat small quantities of blood.

This patient stated that the ulcerations began in childhood, and continued to recur in one or other place till she came to the hospital; she said that the face and neck had been attacked only about four years, and that about the same time her throat became bad and she began to be hoarse; when she was nine years old, she was blind for a year with keratitis. In childhood she was long under treatment in Dublin, and took chiefly tonics and cod-liver oil. In infancy she was very ill.

Her mother had about ten children, of whom five were living at the above date, the eldest being ten years older and the youngest three or four years younger than herself; none of them, so far as she knew, had suffered from the same disease; an elder sister who came with her seemed quite healthy. The patient took five grains of iodide of potassium with ammonia three times a day, using an ointment to the sores, and at the end of a month it was noted that "She has improved in colour and strength, and the sores have rapidly healed."

The question in this case was between lupus and syphilis. The aspect of the ulcers on the face was, to me, conclusive as to its being tertiary syphilis, and I fully expected a history of the *acquired* disease. The patches were large, dusky, scabbed, and cicatrized in parts; the thickening was much softer to the touch than that of lupus, and there was none of the semi-transparent deposit; the scars also were softer than those of lupus. The extensive destruction of soft parts on the forearm was also in favour of syphilis, and so was the periostitis of the tibiæ. The teeth and the keratitis were to me conclusive facts in favour of the disease being *hereditary*. If further evidence were necessary it was supplied by a reference to the age at which these symptoms began.

The case is interesting as an example of hereditary syphilis, remarkably like struma in some features, and like acquired syphilis in others. One of my main reasons for recording it here is, to ask attention to the value of interstitial keratitis when it occurs in connexion with other symptoms of constitutional syphilis, as proof that the syphilis is inherited and not acquired. I am not prepared to deny that there is any form of keratitis in connexion with acquired syphilis which resembles the interstitial so common in association with the inherited disease, but cases which could cause doubt to the experienced surgeon are undoubtedly most rare.

SINCE the last issue of our Journal, ophthalmic science has sustained its heaviest possible loss in the early death of its most zealous and successful cultivator. The discoverer of Iridectomy most certainly ranks as one of the foremost of those who, through surgical knowledge, have conferred benefits on mankind. Although, however, the cure of glaucoma stood foremost amongst the achievements of von Graefe, it was far from being his only one. There was scarcely a subject in the more recondite departments of ophthalmic science to the elucidation of which he had not helped. Nor do we by any means place his chief usefulness in his skill as an operator, or in the value of the contributions which he made to the literature of our speciality. He belonged to a nation amongst whom the vocation of the teacher is held in high honour, and to the end of his life he fulfilled the duties of this calling with the most zealous industry. Probably half of the more distinguished ophthalmic practitioners of the day have been educated to a greater or less extent by his oral teaching, and with many of these such was their reverence for his powers of investigation, that his opinions were received with implicit trust. It was enough that Graefe had said it. To himself, however, this was by no means the case; he was constantly re-examining his facts, and seeking to give new precision to his views.

We have the pleasure in this number of our Journal of presenting to our readers his last essay, in which, with singular appropriateness, he gives the world the benefit of his final conclusions on the subject with which his future fame will be chiefly associated.

No detailed biography of von Graefe has, we believe, yet appeared. Most of the journals have contained short obituary notices, and a good portrait given by one of our contemporaries, has been re-published in America.

We append to our brief expression of the deep sense of loss which every one who knew anything of Graefe's work must have felt on hearing of his death, translations of two of the notices of his career which have appeared on the Continent. One is from the pen of an intimate but non-professional friend; the other comes from his two editorial *confrères*, scarcely less distinguished than himself, Professors Arlt and Donders.

It is to be hoped that the sentiments expressed in the concluding paragraphs of the last named notice will find their echo in the hearts of us all. Graefe's illustrious co-editors find in his death a motive for increased zeal in their work, and they regard the maintenance of the repute of his Journal as a sacred debt to his memory. Let this sentiment be widely felt, and let us all try to appreciate the fact that in the death of a General additional responsibility has devolved upon all subordinates, and that we owe it to the memory of our noble brother to seek to work as he worked, with singleness of purpose, unflinching industry, and untiring faith.

The following pages from the pen of Herr Max Ring, an intimate friend of Graefe's, appeared in one of the Berlin newspapers soon after the event.

“IN MEMORIAM.—ALBERT VON GRAEFE.

“Amid all the noise and hurly-burly of the war, Berlin heard the melancholy tidings of the death of one who had rendered great and imperishable services to both science and humanity. Spite of all distinctions, the whole city, all Germany, indeed the whole world, felt the sad and irreparable loss which was sustained in the death of one who in his own domain was undoubtedly unrivalled, and who had not only gained, but maintained the highest rank,

as a benefactor of suffering humanity, as a highly gifted oculist, as a distinguished operator, as an author, and as a scientific teacher. A. von Graefe was born in Berlin in the year 1828. His father, the distinguished surgeon *Charles v. Graefe*, died whilst this, his youngest son, was yet a boy, leaving a considerable fortune to his family. Very loving care was bestowed upon Albert's education by his accomplished mother, *Augusta von Alten*, who also procured for him the best instruction which eminent masters could afford. The excellent *Dr. Gögel's* influence was paramount amongst all these, and he very early instilled and fostered a taste for mathematical science in his young and clever pupil, who at first aspired only to be a mathematician, but afterwards turned his attention to the natural sciences, bestowing special attention on physics and chemistry. The transition to the study of medicine was easy to one who had ever before his eyes the image of his distinguished father, and the memories of his early childhood, to allure him to such studies.

"As soon as Graefe had finished the prescribed curriculum at Berlin, he took his degree there, and after passing the State examination with the highest honours, commenced his scientific travels, whilst yet only twenty years of age, in company with some of his young friends and fellow students.

"He first went to *Prague*, where scientific medicine had as it were, just begun a new life, and where a band of distinguished men taught and laboured. His zeal and acquirements, as well as the name he bore, speedily gained him the esteem and friendship of Professors *Jaksch*, *Dietrich* and *Arlt*.

"Graefe cherished ever after a fond recollection of the old Bohemian capital, where, he was wont to say, he spent the time of his first love for medicine.

"From Prague he betook himself to *Vienna*, and afterwards to *Paris*, where he stayed the longest. There, indeed, he felt himself truly at home, and the most distinguished scientific men, such as *Desmares*, and *Sichel*, became his friends. After Graefe had gained the objects he sought from the great institutions of the French capital, he returned to his native city, after a brief residence in *London*, *Dublin*, and *Edinburgh*, in order to settle in Berlin as a surgeon and private tutor. But even whilst at Prague, he chiefly interested himself in ophthalmic surgery. His former friend, Professor *Arlt*, has the credit of inducing him so to do. Whilst in Vienna the celebrated Professor *Jäger*, furnished him with the most ample means of observation. Such a spirit as Graefe's is however not satisfied easily with the observations and discoveries made by others. He started a clinique of his own, and as human patients were not forthcoming, he availed himself of rabbits, in which he induced various forms of eye disease artificially. Each animal had his number inscribed on a leaden label, fastened to an ear-ring, and a corresponding number was

entered in his Clinical Journal (case-book), in which a daily record of symptoms was duly made, till the account of the *post mortem* formed a fitting finale to the diary of disease. Thus, aided by his friends, Graefe rehearsed the part he was afterwards to play, and practised on his rabbits those powers of observation which were to be utilized for the aid of suffering humanity at a later date!

"Thus equipped, and as it were already distinguished, he commenced practice in Berlin with surprising success. His name was soon known, and he shortly became the most frequented oculist in that city. The ample means he had at his command, enabled him to erect a clinical hospital of his own. Not only the poor, who were his first patients, but very wealthy, and even royal personages gave their confidence to this young and truly gifted surgeon. Not students only, but practitioners of long-standing attended his practice and teaching, to learn of him. Every day increased his repute. Eye-patients flocked to him from the provinces, from distant countries, and from beyond the sea, to get advice from this surgeon, famous in spite of his youth. The University and the Administration honoured him no less than themselves, by speedily electing him to the offices of Professor and Geheim Medicinal-Rath [Privy Councillor]; whilst foreign Princes distinguished him with various tokens of their regard.

"Although external circumstances doubtless contributed to this, only real talent and true genius could have achieved such success. However highly we may rate the means at his command for attaining success, his own services to humanity and science will always remain truly great. He gave such a new and undoubted impetus to ophthalmology in so brief a space of time, that the sum total of his own contributions seems almost incredibly great; we may affirm without any exaggeration, that *the recent extraordinary development of ophthalmology took its rise chiefly from Graefe's own person and labours*. He elevated ophthalmic medicine, which was previously regarded as a mere appendage to medicine and surgery, to the rank of an independent science. Not that he was lacking in either power of intellect or comprehensiveness, nor like many of his contemporaries, who, like Polypo, rooted themselves to one point in the study of animal cells, or were buried deep in the remarkable phenomena of chemistry and physics; but because the exhaustless wealth of his discoveries, and the rich fruits of his investigations and experiences could not develope themselves satisfactorily on any limited basis, nor be comprehended by a divided interest. Of all parts of the organism, the eye is known to be the most accessible to direct observation, and indeed lies open to it, resembling closely, in its construction, the philosophical apparatus known as the *camera obscura*. The invention of the ophthalmoscope has fur-

nished us with an instrument and means of recognizing and explaining morbid alterations of the internal tunics of the eye, and renders their diagnosis an almost absolute certainty.

"Although the honour of this happy discovery undoubtedly belongs to the celebrated physiologist, Professor Helmholtz, yet Graefe was the first to recognize its great *practical importance*, and to extend its application enormously. Armed with this discovery, he made ophthalmology assume an entirely new form, and take a new and definite significance. He discovered conditions heretofore unknown, and elucidated the true nature of those previously known, but not before explained. Thus he led the way to new and sure methods of cure, which in his own hands were sometimes startling in their success. Graefe's perfect mastery over all the sciences auxiliary to medicine (especially physics and mathematics) greatly contributed to this. He united a happy faculty of combination with an earnest and intelligent love of physiology, and practical cleverness with theoretic culture, and a rare faculty of observation. Thus he was able to elevate ophthalmology to that compactly knit science, intersected by fine mathematical lines, which is recognised as such by every accomplished surgeon of the present day. He was the father and founder of that branch of ophthalmic science which deals with the interior of the eye, and which found an appropriate organ in his "*Archiv. für Ophthalmologie*." Such was the spirit in which he worked and taught, and founded a school of his own, which has sent out the most distinguished oculists in the whole world.

"It would be a difficult and almost impossible task to make Graefe's scientific labours and contributions intelligible to the unprofessional reader, however accomplished he may be, since they principally concern physiology and the medical sciences. We must, therefore, limit ourselves to the most generally understood, and most interesting discoveries of this distinguished surgeon.

"Graefe was the first to recognize a frequent course of extreme degrees of myopia in an insidious form of inflammation of the interior of the eye (*sclerotico-choroiditis posterior*), with which there is often associated blindness from "black cataract," and retinal complications, and by timely application of copious abstraction of blood, combatted it with the happiest results.

"Far more weighty and important are his labours on the so-called "green cataract" (glaucoma), a malady of the eye which was previously deemed incurable, and usually ended in total blindness. With the help of the ophthalmoscope Graefe was able to recognize this common disease of the vitreous even in its very beginning, and to arrest it by an operation as simple as it was happy in its conception.

"Equally interesting are his researches as to those intestinal worms which he observed in the humours of the eye, and was

fortunate enough to remove, thus obviating the else inevitable blindness which threatened.

"The cure of (the less dangerous, but more common) "gray cataracts" also owed to him a simple and safe method of operation, now almost universally adopted by surgeons.

"Graefe also rendered very important services by his accurate investigations of the muscular apparatus of the eye, and their influence in various forms of disordered vision. His work on the "Physiology and Pathology of the Oblique Muscles of the Eye," and that on "Squint," may justly be termed classical, and mark an epoch in medicine. Moreover, Graefe possessed in a high degree a mastery over forms of expression, and a command of language, which give a special value, and a charm of their own to his scientific utterances.

"It appears almost inconceivable how he could have found time to do so much, and such imperishable work, when we remember that almost the whole day was taken up by practice, and that his constantly failing health compelled him to frequent idleness.

"He generally sat down to his "work-table" at 7 A.M., and devoted himself to scientific work exclusively till 9 A.M. Then he delivered his lectures, which were attended not by students merely, but by surgeons practising at home and abroad. Clinical teaching, and attention to his patients at the "Polyclinik," which was daily attended by from 100 to 150 eye-patients, occupied him till 3 P.M. Rapidly despatching some minor operations, he then entered his carriage to visit his patients in town. By 5 P.M. at the earliest he regained his home, exhausted, to get his dinner. Not unfrequently he lacked the needful time for this, and took a frugal dinner in his carriage. At 6 P.M. he saw private patients at his own house, and this lasted some hours, as there were generally 50 to 70 such. When they had all gone he returned to his forsaken scientific labours, which often occupied him till the early morning hours. Thus all his life, excepting some two or three hours a day, was given to work. Yet Graefe was by no means an ascetic pedant, or an enemy of social joys. As long as he was unmarried he associated with his young friends and assistants, who were mostly fellow-students. In the winter he often played Ombre; in summer he preferred to amuse himself with his gun in the country. He did not care for large parties, preferring a smaller circle of accomplished men and women, to whom he felt specially attached—a circle which included *Ernst Dohn*, the gifted editor of "Kladderadatsch" (the German "Punch"), and his interesting wife; the amiable Countess *Clotilda von Kalkreuth*; *Hiersemenzel*, the barrister; *Dr. Waldau* (Schuft), the oculist, and his wife; *Lind Fuhr*, the ex-court comedian; and the writer of these recollections, who met once a week regularly at Graefe's house. A cheerful unconventional tone predominated in these assemblies, and in such society Graefe developed his

innate worth and amiability, and his natural liveliness of disposition ; whilst in his rôle as host he charmed all hearts. After his marriage with the *Countess Keuth* he lived almost exclusively in his family circle, happy in a charming domesticity.

"Graefe loved nature, and the country above everything, and in them he yearly recruited his enfeebled health, and gathered fresh powers for his overwhelming exertions. He spent most of his holidays in the Swiss Alps, and Savoy. Monte Rosa was a specially favourite spot of his. In his youth he was considered an intrepid mountaineer ; but in later years, when chest-disease forced him to be more careful, he went every year to the watering place of *Heiden*, in Appenzell, where he felt himself most at home, and where indeed he was considered to be the principal visitor, and honoured as the *genius loci*. Even there many patients, often from great distances, followed him for advice and aid. Combined with his love of nature, Graefe exhibited the liveliest interest in art, especially in music ; and spite of his numerous engagements very few important literary or artistic events escaped his notice. As a man, Graefe was distinguished by a fine sense of justice, and by his uprightness, both in his own conduct, and in his judgments of himself and others. He gladly recognized the labours of deserving foreigners, whilst he was modest in the extreme as regards his own discoveries.

"To his colleagues he appeared as amiable as he was manly, and only where he saw gross ignorance and unscientific arrogance united with obscurity of expression, did he display himself as a sharp and almost annihilating critic.

"Towards his clients he showed the greatest sympathy and patience. Rich and poor received the same attention. His consulting-room was always open to the needy, and his benevolence was not confined to the mere giving of professional advice. He devoted a great part of his large income to the welfare and improvement of his fellow-men. Many a man owes to Graefe not only the preservation of his sight, but even his daily bread ! To his own friends he was the best of friends, in sorrow, as in joy—always interested in them, and their affairs. Amongst these he reckoned his assistants and fellow-students, with whom he always maintained the old footing of his college-days. He preserved pleasant memories of his first year at college with them, the relics of which, the polished rapier [duelling-sword], the flat student's cap, and the variegated sash of the student's "Union" were piously preserved by him.

"This attachment to old and beloved associations was a peculiar and amiable trait in Graefe's life and character. His old nurse, and the old coachman, *Paddenheim* (an heirloom of the family) always lived in his house.

"With a powerful intellect Graefe had also a depth of kindly nature in him, only fully known to his nearest companions and

friends. His outward appearance corresponded in no slight degree with his real nature. The tall, slender figure, somewhat bent forward, gave him an almost transcendental appearance, since the soul, as it were, conquered the body, and the weak body appeared only as the transparent veil of the immortal spirit. Noble and finely cut features, surrounded in his youth, with dark locks, which reached his shoulders, whilst an ample beard covered both chin and cheeks, made the most superficial observer aware that he was in presence of no common man, and of no ordinary nature.

"The serious expression of the high, clear, and reflective forehead, was softened by the friendly smiles of his fine lips, and the benevolent glance of his dark eyes. Of late years, disease and incessant labour had rapidly changed the dark hair to grey, and his interesting features showed lines which marked the presence of the fatal foe he bore in his bosom. Ere he had completed his 43rd year, Graefe's sufferings terminated. What he has achieved, and that which he has bequeathed us, is as great as his life was short. His fame is well ensured; his name will live for ever in the annals of science, but his best and fairest fame lives in the hearts of thousands, to whose darkening eyes he gave or preserved that priceless boon, the very source of light, the power to see.

"Berlin, July 23, 1870."

The following notice is extracted from the "*Archiv. für Ophthalmologie*," band xvi, abtheil 1, 1870 :—

"For the first time in a long series of years this volume of the Archives appears without any contribution from the pen of the gifted and distinguished man, who established them in conjunction with ourselves, and by whose name they were known all over the medical world. He had indeed selected, arranged, and prepared some manuscript for the press, but his rapidly failing strength forbade his enriching this number with any of his own work. In the evening hours of one of the few hot days of this cold and rainy summer, Graefe enjoyed the coolness and refreshment of the garden-saloon of his beautiful house. To ensure the same comfort for him all through the night, a bed was got ready for him in this situation. About midnight, as was his wont, he retired to rest; more comfortable, and perhaps freer from thoughts of death than he had been for a very long while. He was soon seized with excruciating pains, which, after considerable suffering, brought his richly-productive life to a sudden close.

"Von Graefe left us on the night of the 20th July, in the midst of the tumult and confusion caused by the outbreak of a fearful war. To say anything to the readers of this journal of

this man's position in science, or of the high-toned impulse which ophthalmic medicine and surgery derived from his guidance, or to mention the pre-eminent place he held as a teacher of studious youth would be quite superfluous, would, indeed, incur the charge of taking owls to Athens. Our readers surely need no words of ours to remind them what these Archives (to the joint-editorship of which our departed friend invited us in 1855, after one volume had been published under his sole superintendence) owe to him, for Graefe himself has furnished abundant proofs of this, which stand like milestones along the road of the last 15 years. But this we may say, that we hold it a sacred debt, due to the departed, to continue the editorship with like intentions and in the same spirit as he displayed, and to maintain for this journal the influential position it has hitherto held in ophthalmic literature. Whether we shall succeed in so doing depends greatly on the continuance to us of the loyal support of our fellow-labourers in the same vocation with which the Archives have so long been favoured. We know that in thus continuing the work, we are fulfilling the special wish of the dear departed, and we make the request for aid from German and foreign ophthalmic surgeons in his name.

"But looking back to the freshly-opened grave of our never-to-be-forgotten and never-to-be-replaced Albrecht von Graefe, our mournful cry must be—

"AMICISSIME REQUIESCAS IN PACE!"

"F. ARLT.

F. C. DONDEES."

PART II.

A Periscope

OF

CONTEMPORARY OPHTHALMIC LITERATURE.

A CONTRIBUTION TO THE PATHOLOGY OF THE VITREOUS HUMOUR.

By Dr. Hermann Pagenstecher, of Wiesbaden.[Translated from No. 43 of the *Centralblatt f. d. Med. Wissensch.*, 1869.]

I PROPOSE in this paper to give a brief account of the results of a long series of experiments made by me in the spring of the present year, whilst residing in Marburg. The purpose I had in view was to investigate with the ophthalmoscope the development of the changes induced in the vitreous of the rabbit's eye, by a variety of traumatic lesions; and at the same time to study the various stages of these processes by the aid of the microscope. I made it a special object to elucidate the question of the possibility of independent inflammations of the vitreous itself, by endeavouring to excite a strong inflammatory action in its very centre, by means which should cause as little disturbance as possible in the investing membrane. After many experiments, I came to the conclusion that the injection of irritants in a state of solution was undesirable, and the method I finally adopted was briefly as follows:—

A very fine, sharp canula (from Pravaz' syringe) was filled with an irritant in a solid form (particles of wire, wood, glass, and other substances were used), and introduced into the centre of the vitreous, the contents being pushed on with a fine wire. But in order to better investigate with the ophthalmoscope the phenomena induced in the vitreous by a strong irritant, as well as to facilitate microscopic investigations afterwards, with as little disturbance of parts as possible, I modified these experiments by using a small capillary (vaccine-lymph) tube filled with croton oil, having its outer extremity closed with wax. This was then introduced in the same manner as before, by means of the canula, into the very middle of the vitreous.

The appearances produced by these experiments lead to the following conclusions, which contrast strongly with the received opinions on the nature of the vitreous humour:—

1st. Neither the gelatinous substance of the vitreous, nor the structures contained in it, are capable of developing lymphoid corpuscles, as the result of the introduction of irritants which induce morphological changes, and inflammatory appearances in other tissues. From which it results,

2ndly. That these must find their way there from the contiguous organs.

3rdly. The vitreous appears to be quite indifferent to the action of very strong irritants, or, to speak more precisely, they do not produce in it any collection of lymphoid corpuscles, an appearance which is seen to be uniformly and rapidly produced by them in all organs susceptible of inflammation.

4thly. The vitreous cannot, therefore, be said to be susceptible of inflammation in the same sense as we speak of other organs. But every so-called inflammation of the vitreous ought to be considered as secondary to the alterations produced in other organs. Any irritant, therefore, in the vitreous will only induce inflammatory appearances as a consequence of active inflammation of surrounding vascular parts.

Simultaneously with these experiments, I had ample opportunities of investigating extravasations of blood in the vitreous humour, and the changes undergone by these; and, therefore, I was able to confirm the observation of Langhan, on blood-extravasations generally, namely, that the red blood-discs are taken up (introsumed) by the contractile spherical corpuscles (*rundzellen*), because I happened to see this process going on in a fresh preparation of the vitreous of a rabbit.*

Further corroboration of the above views, and the detailed description of the last experiments will shortly be published in a larger work.

CONTRIBUTIONS TO THE PATHOLOGY AND TREATMENT OF GLAUCOMA.

By the late Professor von Graefe.†

The Nature of Primary Inflammatory Glaucoma.—Of all the forms of glaucomatous disease, this is undoubtedly the one best

* I have not been able to refer to the observation quoted. In the "New Sydenham Society's Year Books for 1863-4, and in Mr. Simon's article on Inflammation, in Holme's System of Surgery, there are references to observations by Dr. W. Preyer (in Virchow's "Archives"), Hackel (Leipsic, 1862), and von Recklinghausen on the amæba-like movements of pus, connective tissue, and (white) blood cells, with allusions to their absorbing colouring matter, and coloured corpuscles of the blood, &c. In this way the "blood corpuscle-holding-cells" of some pathologists are supposed to be formed.

P.S.—The last edition of "Carpenter's Physiology" may give some further account.

† Translated and somewhat abridged by Thomas Windsor from the "Archiv. f. Ophth.," xv, 3, p. 108.

understood in respect to its pathology and treatment. The morbid phenomena certainly commence in the uveal tract; as the latter is the source of the intraocular fluids and regulates the tension of the eye, it is obvious that inflammatory irritation of it may lead to excessive secretion and increased tension. We are indeed obliged to admit certain predisposing or co-operative conditions in the nerves, vessels, or tissue itself, owing to which a serous choroiditis and irido-choroiditis assume the characters of acute glaucoma; for we meet with other inflammatory irritations of the same parts, accompanied by active or predominant absorption of the ocular fluids and normal or diminished intraocular tension. Yet as we have in other parts of the body numerous examples of the so-called secretory inflammations, in which the pressure in the tissue or the cavity is much augmented beyond its normal amount, we keep within the limits of current pathological thought, when we admit a definite form of irido-choroiditis, the very essence of which is to cause increased tension with its consequences.

Participation of the Retina.—The state of the *retina* and the manner in which blindness is produced in primary inflammatory glaucoma, may furnish subjects for discussion. Is the retina itself actively diseased? A question to which pathological anatomy will probably not furnish an answer; for the processes concerned are, it may be supposed, very transitory, and though we find the most various parts gradually implicated as the disease progresses, we must be extremely cautious in respect to any changes found in the retina at a late period. Besides as to the condition of the retina after typical glaucoma, there are as yet no anatomical alterations shown which have not resulted from an interruption in the fibres at the edge of the excavation, and which are therefore indisputably secondary. Our opinion must for the present be guided by the functional and ophthalmoscopic examination. It may well be maintained in cases of slight glaucomatous obscuration that the vision is impaired proportionally to the cloudiness of the media, so that there is no reason for supposing any impairment in the retinal conduction. We see patients in whom the aqueous is distinctly clouded, reading fine print, and must refer the impairment of vision to the optical interference, all the more because it is extremely probable that there are also similar diffuse opacities in the vitreous humour. In severe glaucomatous attacks the vision is often impaired to an extent that cannot be explained by even the most advanced opacities of the media. When the attack has been preceded by chronic glaucoma with excavation of the disc, we might imagine that the conduction of the retinal fibres which had been already seriously implicated, could be entirely arrested at the edge of the excavation by the suddenly-increased tension; when, however, the eye has been previously normal, or simply presented pre-

monitory symptoms, there can be no question about excavation, for the production of which a considerable time is necessary. The functional paralysis certainly justifies the suspicion of an accessory *retinal affection*.

This view is supported by the occurrence of *retinal ecchymoses* after iridectomy. Further experience has shown the essential correctness of my views.* The ecchymoses appear to be always present, when iridectomy is performed during an acute attack accompanied by great haziness of the media and great tension; they are then especially found near the disc and macula lutea, though they may extend over a large part of the fundus and even be accompanied by ruptures towards the inner surface of the retina. When the acute attack is attended by great cloudiness of the media, but with only moderately increased tension, the ecchymoses are common enough, though not quite the rule; they are usually more isolated about the posterior pole, forming only delicate rosy spots, whilst larger masses and ruptures towards the hyaloid are absent; they usually also disappear rapidly, so that their existence must be determined at all events within the first six or seven days. Retinal ecchymoses occur in a small proportion of cases, I might say exceptionally, when the media are but faintly clouded, whilst the pressure is much augmented. According to my experience they are not found at all in non-inflammatory glaucoma. In short, the inflammatory cloudiness of the media is the condition *sine quâ non* for their occurrence after iridectomy, whilst the degree of tension regulates the amount of the hemorrhage. I formerly considered them due to the sudden relaxation of pressure, yet when we consider how exceptional they are after operations in which the anterior chamber is opened, and that they are absent in non-inflammatory glaucoma, even when there has been most marked increase of tension, we must at all events allow the insufficiency of that explanation. Even supposing that diminished pressure is the direct cause of the ecchymoses, we have yet every reason for admitting a previous morbid state of the retinal tissue. Yet I do not think that we should imagine it to be morphologically a very marked one. The interrupted and therefore insufficient arterial current shown by spontaneous arterial pulsation which is rarely absent during a glaucomatous attack, the venous constriction, and finally the imbibition of the retina with pathological fluids thrown out by the uveal tract, may produce a state of fragility (softening?) of the retina. There is no such infiltration of the retina in the non-inflammatory form; whilst the circulation is usually less impeded, probably owing to the

* With the exception that I formerly believed (A. f. O., iii, 2, p. 502) that occasionally the ecchymoses pre-existed, only increasing after the operation. A case, in which there had been previously hemorrhagic retinitis, was probably the cause of the error.

more gradual increase of pressure. In an attack of inflammatory glaucoma—the slighter forms of obscuration, in which the ophthalmoscope can still be used with effect, prove this best—there is almost always spontaneous arterial pulsation, but in the non-inflammatory form it is only in exceptional cases spontaneous, the rule being that some pressure with the finger, less indeed than for the normal eye, is necessary for its production.

Nature of the Blindness.—Hence it appears that the *blindness* in acute inflammatory glaucoma is essentially a paralysis of the retina from ischæmia, the participation of the venous congestion, of the infiltration of the retina with pathological fluids in this paralysis or in the accompanying nutritive changes remaining uncertain.

It cannot be admitted that the increased pressure arrests the nervous conduction. The nerves will in general bear very considerable pressure, and specially in regard to the optic nerve this can be shown by numerous examples of disease, always supposing that the blood-vessels included in the nerve are not compressed at the same time. The terminal apparatus in the retina will probably suffer more from pressure than the fibres; yet, even as to the middle and outer retinal strata, much greater pressure would be necessary than that found in glaucoma. The intermediate agent is here, as generally in cases of "nervous paralysis from pressure," the arrest or *impeded flow of the arterial circulation*.

The *course* of primary inflammatory glaucoma and the effects of treatment are very regular, considering the enormous differences of degree and duration. The prognosis can be fixed with a satisfactory definiteness. Although it is certainly advisable to excise the iris freely and as peripherally as possible, yet the non-fulfilment of these conditions is by no means always, not indeed usually, followed by insuccess. I have seen a very great number of eyes in which the operation had been imperfectly performed for typical inflammatory glaucoma, and yet in which the cure had been permanent. The more the disease is attended by sudden cloudiness of the media, so much the more does the important point appear to be the excision of the sphincter pupillæ, whilst the really correct operation is the more indispensable, the less the media are hazy and the more the disease is simply characterised by increased tension. I would fain hope that these remarks will not induce carelessness in excising the iris; I consider that the best guarantee is given in all cases when the operation is performed according to the well known rules; yet for the explanation of the effect (in comparison with simple paracentesis) it must be of consequence, that the result may be permanent, though the periphery is not removed. This fact may also restrain the surgeon from too soon performing a second operation, upon the supposition that the first cannot possibly suffice.

The tension is usually *well relaxed* immediately after the operation, even when it had been immense during the inflammatory attack, *i.e.*, it only moderately exceeds that of a punctured

eye. For a few days it increases somewhat, though usually not to any great amount, but it again diminishes spontaneously, either disappearing entirely, or leaving what is compatible with vision. The anterior chamber is permanently refilled, almost without exception in a few days, sometimes immediately after the operation. I note this circumstance here, because it is of importance with reference comparatively to many forms of non-inflammatory glaucoma.

Tendency of the Second Eye to Glaucoma is increased by Iridectomy.—That in inflammatory glaucoma the performance of iridectomy on the one eye promotes the outbreak of glaucomatous symptoms in the other (Vid. A. f. O., viii, 2, p. 255) has been confirmed by some observers, recently especially by Mooren (Ueber sympathische Gesichtsstörungen, p. 98), whilst others, for example, Arlt, look upon such a sequence as only accidental. Bowman also seemed to me in conversation not to be convinced that there was any real connexion.* My opinion is settled by what I have seen and noted in the last seven years, and I must now express myself more decidedly than formerly. I cannot admit that, from my manner of performing iridectomy, there is any reason why the second eye should be specially liable, in comparison with the practice of my colleagues. This could only be due to greater dragging of the periphery of the iris, and this I most carefully avoid; besides, in the cases in question, the course of the operated eye is perfectly normal, free from any increased sensibility of the ciliary region to the touch, &c.

I may take this opportunity of again pointing out the conditions under which the sequence is observed:—

1. The outbreak of glaucomatous symptoms in the one eye during the first two weeks after iridectomy on the other occurs only when the latter suffers from *primary inflammatory glaucoma* and is operated on during the period of irritation. I have not observed such a succession in cases of non-inflammatory or secondary glaucoma.

2. The succession is especially frequent, excluding in my

* Laqueur (Ann. d'Ocul. 1869, Jan.-Fev., p. 58) doubts this effect of iridectomy, because he has observed the same succession, without the intervention of an operation, thrice in 21 cases of acute glaucoma. Every one with a large practice can no doubt adduce examples of rapid spontaneous succession, but the proportion to the total number of cases, 1:7, as given by Laqueur, is decidedly not the average one. In Berlin the percentage of acute glaucoma seems to be considerably greater than where Laqueur observed, about 30 cases being operated on each year. I have also made use of the statements of many blind people, in whom there could be no doubt as to the precedence of acute glaucoma, from the history and appearance of the eyes. Thus, I found more than 300 cases of acute glaucoma when, four years ago, I collected my notes together. Even if I include, as cases of rapid succession, the patients who were no longer certain whether the second eye became diseased after some months or after a few weeks, the proportion would not then amount to 1 in 12; it is probably from $\frac{1}{15}$ th to $\frac{1}{18}$ th.

opinion the supposition of an accidental coincidence, when, under the circumstances just mentioned, the second eye already presents *premonitory symptoms*. A decided glaucomatous attack occurred in the second eye within fourteen days after the operation in 25 per cent. of those so treated, during the last two years indeed in rather more than 30 per cent.

Besides these cases in which iridectomy was of course performed on the second eye at once, a smaller series was noted, where, under the same conditions, the premonitory symptoms became more frequent after the operation, but again recurred at longer intervals after the first week, so that the operation was not urgently demanded. I operated during last year on two cases, in which the premonitory symptoms had previously recurred at intervals of months, whilst after the operation they recurred every evening, from the 2nd to the 4th or 6th day respectively, and then again there were intervals of weeks or months.

3. I have tolerably often seen the second eye become diseased soon after the operation on the other, where there had been previously no premonitory symptoms in it. A succession is, however, far rarer than when there are already premonitory symptoms, although it occurred in my experience more often (in about 10 per cent. of cases operated) than it does spontaneously within so short a period (in at all events less than 8 per cent., probably in only 6 per cent.), yet the number of cases in comparison with the differences is not sufficiently large to be decisive. I therefore limit my assertion still to those cases in which there are already premonitory symptoms; the question of an influence of less amount* must be left for decision to future observations.

I do not imagine that suppression in the one eye promotes the outbreak in the other, but I think that the traumatic irritation of the iridectomy or of the healing process radiates to the second eye.† This view is favoured by the fact that the tendency of the second eye attains its maximum‡ during the first few days after the operation, as it seems from the 2nd to the 4th day,

* This influence seems to be shown by two recent cases, in which the second eye had remained absolutely free during a premonitory stage of three and ten years respectively; finally, when acute glaucoma supervened, and was treated by iridectomy, cloudiness of the aqueous with iridescent vision occurred in the other eye, respectively on the second, or second and third days after the operation, and then again did not recur (now respectively half and three-quarters of a year afterwards). I am far from maintaining that iridectomy specially promotes this succession in comparison with other operations. I have once observed exactly the same result after removal of a cystoid cicatrix, and am rather inclined to believe that other operations would have this effect to a yet greater degree in proportion to the transitory irritation of the ciliary region which attends them.

† In agreement with Mooren (l. c., p. 98).

‡ The second eye is usually attacked by glaucoma in this period, only in very rare cases in the second week.

and also that promonitory symptoms become more frequent, or first appear, within a few days after the iridectomy.

Secondary Glaucoma; its Nature.—The pathology of secondary is far more complicated than that of primary glaucoma; indeed, from the varying nature of the primary affection, from the differences in degree and kind of the secondary state, and from the diversified reaction of the latter on the former, we meet with an infinite series of combinations, often opposing many difficulties in the way of analysis. No general statement can be made in respect to the power of iridectomy in this form of glaucoma, as a few examples will show. Some forms may be stopped by operation even in their last stages; such are those due to circular posterior synechiæ and to collections of retro-iritic fluid. We cannot of course restore in this way the nerve-fibres destroyed by the excavation of the disc, but we stop the increase of tension and the progress of the disease. In other cases iridectomy fails, or acts with great uncertainty, in diminishing the tension, as in the form dependent on retinal hemorrhage. Then we find examples where the operation seems not to lose its effect in respect to the pressure, but yet in which the prognosis is unfavourable owing to the primary lesion, as in cases of corneal ectasy; sometimes, indeed, the operation is contra-indicated by a tendency to cyclitis, as in cornea globosa. Finally, there are cases in which the secondary irritation is too great to be permanently modified by anything that does not act directly on the cause itself; such we find, at all events, at intervals, when the lens is placed obliquely, or dislocated behind a prolapse of the iris.—As our experience enlarges, we become more and more conscious how numerous are the considerations bearing on our treatment.

Secondary glaucoma may proceed from almost any inflammatory affection of the eye. I think, however, that the diseases which during their typical course are wont to modify the ocular pressure within a bearable amount, present a greater tendency to secondary glaucoma than those that do not usually do so; for example, there is a greater tendency in diffuse keratitis than in cases of circumscribed corneal infiltration, in equatorial choroiditis with opacities of the vitreous than in choroiditis disseminata.

Affections of the Conjunctiva and Cornea.—Glaucoma is scarcely ever originated by diseases of the conjunctiva, unless the irritation has extended to the cornea, iris, or ciliary body. A frequent source is found, however, in diseases of the cornea.

I was formerly inclined to think that, besides the corneal lesion, other complications in the uveal tract were necessary for the production of glaucoma. Now, though this is decidedly the most usual process, purulent infiltrations, ruptures, &c., inducing increased pressure through the implication of the iris and ciliary

region, yet I am fully convinced, that irritation of the cornea (or of its nerves) alone, without any complication, may excite glaucomatous increase of pressure.

*Limited Corneal Infiltration (genuine circumscribed Keratitis).—*This process, according to my experience, has hardly any influence over the tension, as estimated by the touch, and this may explain why it is rarely, if at all, the cause of glaucoma. I have only seen once a succession, at all events in respect to time. I may briefly relate the case on account of its rarity.

A woman, fifty odd years old, who had suffered for many years from eruptions on the extremities and occasionally on her left cheek, applied at the Clinic in June, 1866, for an ophthalmia of about a week's duration. We found an old eczema behind her left ear, an eczematous patch as large as a four-groschen piece at the lower part of the left cheek, on both sides blepharadenitis, and, finally, the special cause of her application, a circumscribed infiltration of the left cornea. The latter presented typical characters: there was an opaque and somewhat swollen spot, measuring 1.5 mm. opposite the lower edge of the pupil; its centre was yellow and opaque, passed into a light grey towards the margin, and merged gradually into the adjacent healthy cornea; the centre also projected and presented a slight excoriation. The pupil was small; it dilated on the use of atropine completely, though, owing to the existing irritation, slowly; the vision was quite in proportion; the tension was not tested at first, as there seemed no reason for suspicion.

The disease was unusually obstinate, owing, as we supposed, to the eczematous tendency. This led to a more careful examination, and it was expressly determined in the fourth, and again in the sixth week, that there was no complication whatever with disease of the internal organs; the tension was perfectly normal, not only within the physiological limits, but it did not even approximate suspiciously to the normal maximum, or vary from that of the right eye. The ciliary neurosis continued moderate till the eighth week; it then for the first time considerably increased, the aqueous became slightly clouded, the anterior chamber somewhat flattened, and the tension greater than in the other eye. The pupil was of tolerable size, though atropine had not been applied for the last eight days (the patient had been away).* From this time, whilst the original infiltration of the cornea remained wonderfully stationary, there supervened a subacute, perfectly typical glaucoma; paracentesis twice repeated had no permanent effect, and in the twelfth week from the com-

* I mention this, because I agree with the opinion that mydriatics may excite an acute attack when there is a tendency to glaucoma. I have mentioned this before in the Archiv., and was so much the more pleased to find an independent communication by D. H. Derby, in the Transactions of the American Ophthalmological Society, 1869, p. 35.

mencement of the disease indistinctness of excentric vision at the inner side necessitated iridectomy. It was followed by the desired reduction of tension and by a rapid cure of the so obstinate corneal infiltration.

As, however, this is the only case in which I have seen typical circumscribed keratitis followed by glaucoma, it may well be imagined that the succession was accidental or that both affections were due to the eczematous diathesis.

Diffuse keratitis influences the tension to a rather considerable degree in most cases. During the increment of the disease we sometimes find a decided increase, whilst at the acme and commencement of the decline there is a distinct diminution; the eye may indeed be so soft in severe cases as to excite the fear of phthisis bulbi. Fortunately the latter rarely ensues; the tension gradually returns as the disease retrogrades. There is good reason for believing that diffuse keratitis is complicated with cyclitis when the pressure is extremely diminished, especially in dyscratic children; this view is supported by the insidious formation of posterior synechiæ, by the disproportionate deterioration of vision, and deficiency or great impairment of portions* of the visual field.

The general prevalence of absorption over secretion in diffuse keratitis may explain the exceptional occurrence of secondary glaucoma. I have observed this event only in some elderly people, in whom, moreover, the disease is relatively rare. After a lapse of one to three months, when the greater part of the cornea had become opaque, though to a very unequal degree, the tension increased, some haziness (it was difficult to estimate its degree) of the aqueous supervened, and finally iridectomy had to be performed for these reasons, and owing to impairment of the vision. Two of these individuals—one was a Berlin medical man---were extremely gouty, a third suffered from chronic eczema and much from hæmorrhoids; in the fourth, and there ends my list,† no special cause could be found. In all these cases iridectomy acted satisfactorily on the tension, but in two the opacities of the cornea became sclerosed (nahmen einen sclerosirenden Character an), vision being considerably damaged; such a tendency had, however, shown itself before the operation. The

* A satisfactory explanation is still required for the indistinctness or defect which accompanies great diminution of the ocular tension. No conclusions can be drawn from ophthalmoscopic examination, owing to the diffuse opacity of the cornea. The optical change cannot explain the more complete defects at all events; the usual form of separation, or any decided organic change of the retina, is incompatible with the ulterior recovery, so that I am inclined to refer the state to limited circulatory changes in the retina, perhaps accompanied by œdema, which would be likely to attend extreme diminution of the ocular tension.

† An interesting case, doubtless, of this kind has been published by Coccus, A. f. O., ix, 1, 6.

disease was monolateral in three cases, in one it attacked the two eyes at an interval of six weeks.

Sclero-keratitis.—This leads me to that form of chronic keratitis which is generally accompanied by inflammatory ectasia of the anterior hemisphere (what is called sclerotico-choroiditis anterior), and in which the infiltrations become immediately sclerosed; the latter are grouped like clouds, or extend over a segment of the cornea. Glaucomatous tension follows this process only occasionally and scarcely ever except at a late period. According to my experience, iridectomy reduces satisfactorily the tension, but is prone to excite further sclerosis of the opacities. I therefore advise, unless there is some urgent indication, the previous performance of peritomy (with active scarification of the episcleral vessels); I have found very decided benefit from this means, especially in regard to the tendency to sclerosis; it seems also to have some temporary effect in reducing the tension. Where there is already much bulging of the pericorneal zone, there is some risk of plastic cyclitis being excited by iridectomy, yet the danger compared with the relief is not so great as to contra-indicate this treatment, whilst at the same time it must modify our prognosis. This form of glaucoma seems almost always to attack both eyes, yet not at exactly the same time, and it often does not attain the same degree in the eye last affected.

Keratitis pannosa is far more often the origin of glaucoma than is generally supposed. Glaucoma sometimes springs directly from the irritation of the cornea, which is usually becoming atrophied and projecting; sometimes serous iritis intervenes between the two affections. The iritis furnishes in my opinion not unfrequently the reason why pannus is so obstinate: it may be readily overlooked, the increased depth of the anterior chamber which is at least in part due to the augmented pressure in the anterior chamber (inflammatory hypersecretion of aqueous humour) being referred simply to the diminished resistance of the cornea, and the delicate diffuse cloudiness of the aqueous being unnoticed behind the coarser anomalies of the cornea. Unless the practitioner is attentive, he only notices how badly the eye bears the mildest topical applications, the considerable pericorneal injection, and that the latter increases after any irritation. Serous iritis probably is most often the intervening link between pannus and secondary glaucoma. In many cases, however, we meet with the latter unaccompanied by any iritic symptoms; we then usually find that it has been preceded by deep ulcerations or partial projections of the cornea, which we have no hesitation in considering its cause.

In this form of serous iritis, single or repeated paracentesis generally suffices; it thus becomes an important agent in rebellious pannus, whilst iridectomy is decidedly indicated as soon as

glaucoma appears. It cannot be denied, that the operation is frequently followed by a temporary increase of vascularity in the cornea ; it however soon retrogrades, and we find a very beneficial influence over the original disease exerted by the diminution of the pressure. Spontaneous improvement now ensues, or the eye will bear topical means, just as after paracentesis of the anterior chamber in simple serous iritis. As a general rule, we may repose greater confidence in the operation when the glaucoma is due to the intervention of iritis than when it is due directly to the changes in the cornea. There is indeed some danger of cyclitis when the membrane is very prominent in a case of pannus, a danger influencing our prognosis, but not contra-indicating the operation (as a last resource). We should make it a rule to carefully watch the intra-ocular pressure in all cases of inveterate pannus, and to proceed to the operation as soon as it becomes permanently increased. I learn from Dr. Tachau, now largely occupied with this affection in Egypt, that it is there more frequently followed by glaucoma and at a still earlier period than with us.

Like the primary disease itself, secondary glaucoma is frequently observed in both eyes, yet often enough we find it only in the eye first affected.

Corneal Cicatrices.—It is well known that glaucoma arises from cicatrices of the cornea, the result of deep ulcerations of very various nature. The fact that ultimate blindness often occurs after prominent corneal cicatrices, was noticed, specially by Arlt, at a time when the causal connection, the reaction of the ocular pressure on the optic nerve, was entirely unknown. Doubtless glaucoma occurs infinitely more often where there is synechia anterior after perforation of an ulcer, than where the latter has not perforated at all, or where the iris has again receded from the wound. Yet it is an error to suppose that such adhesion is a *conditio sine quâ non*. I have seen by no means unfrequently cicatrices after central ulcers from blennorrhœic, diphtheritic, or pustular ophthalmia, where there had been no perforation, followed by expansion of the chamber and ultimately by glaucomatous tension. At the same time I must admit that in all cases the ulcer had been deep and extensive, and that usually cicatrization had been irregular with recurrent irritation (so that we can admit the occurrence of specially active irritation of the corneal nerves by pressure, traction, &c., during the formation of the cicatrix) ; inclusion of the iris much intensifies the danger. For this reason it is of great importance to prevent synechia anterior in perforating ulcers and wounds, just as it is to avoid synechia posterior in iritis. As to both forms, glaucomatous tension follows in only the minority, fortunately for the patients, yet both are attended by permanent risk in every case. We have noticed not unfrequently, that eyes affected with synechia

anterior or leucoma adherens, after being good for many, many years, are ultimately attacked by glaucoma on the approach of old age.—The forms now under consideration affect one or both eyes, just as the primary disease.

It is commonly asserted that the cicatrices, that predispose to glaucoma, are prominent. It is quite true that leucoma prominens adhærens or staphyloma parziale threatens glaucoma far more than an equally large, but not prominent, cicatrix; yet it is not the projection, the special absence of resistance of the newly formed tissue, that is the cause. The loss of resistance explains why the tissue yields at the seat of perforation even to normal pressure when the process is recent, as for example in a partially cicatrised prolapse of the iris. On the other hand, the resistance becomes adequate in older cases; we find the cicatrix receding gradually to its proper level, unless it is opposed by abnormal intra-ocular pressure. Continuance of the prominence shows therefore that there is too great pressure on its posterior surface, at all events for a considerable period, till the new tissue has acquired a definite form due to its own structure.—With normal anatomical conditions, there cannot be a great increase of pressure in the anterior division of the eye, in the anterior chamber and the retro-iritic space, without an increase in the vitreous body, though to a little less degree. In cases of disease, where a partition is formed, by closure of the pupil, solid retro-iritic exudations, &c., between the anterior and posterior divisions of the eye, there may undoubtedly be very considerable increase of pressure behind a cicatrix without any notable increase in the vitreous space. Such is the state, as shown by palpation and the curvature of the sclera, in a great number of staphylomata and projecting cicatrices. The secretory irritation in the cavity of the staphyloma or in the anterior chamber is often transmitted backwards, exciting glaucomatous symptoms. The projection of a cicatrix is, indeed, accompanied by conditions closely allied to those obtaining in secondary glaucoma. We by no means deny that expansion of the cicatrix and of the adjacent parts may exert an injurious reaction, and thus be concerned in the production of the succession in question.

The conditions, with which we are here concerned, are very complex. The irritation in the fundus of the ulcer and in the cicatricial substance must be the source of the subsequent increase of tension, when there is no adhesion of the iris. When there is a perforation, the incarceration of the iris, the dragging of the same part and of the ciliary organs, may occasion the increase of pressure; yet in most cases, especially when there is a large perforation, the lens is the most important agent. Destruction of the zonula and consequent obliquity of the lens, pressure by it against the already irritated iris, prolapse of the whole crystalline system into the cavity of the staphyloma, or

even rupture of the capsule with swelling of the lens-substance, then originate the secretory irritation. The latter may, as the history of staphyloma teaches, be limited for an indefinite period to the anterior portion of the eye; it may, however, at any time excite secondary glaucoma.

The greatest attention must be paid to all the objective symptoms, for these processes usually occur during childhood, when no great reliance can be placed on functional examination, and the effect of the treatment depends on the stage of the disease. It is indeed mournful how many eyes, after escaping entire destruction from ulceration, as in ophthalmia neonatorum, are afterwards rendered blind by secondary glaucoma, for which active treatment has not been used in time. Every eye that presents a corneal cicatrix, and especially an adherent one, should be carefully watched, and no love of general principles should induce the surgeon to postpone the operation to a later period of life. It happens sometimes that the parents continue hopeful, and again apply at the time directed, but then it is found that the operation is inadmissible. No doubt it seems desirable for many reasons to postpone iridectomy in a child. Yet there is one urgent indication, never to be overlooked, owing to which the operation must be performed at any age; that is, an increase of the intra-ocular tension. Its first symptom in children with leucoma is usually an *expansion of the anterior chamber*. In them the resistance of the tissues is very different from what it becomes at a later period, when the optic disc usually yields (becomes excavated); the cornea and pericorneal zone give way in early childhood; excavation of the disc does not occur till a relatively late period. The augmented corneal diameter, the ectasy and the bluish semi-transparency of the pericorneal zone, the atrophy from expansion (discoloration and radial fissuring of the iris) are extremely important signs: the practitioner must never await their full development, for by such delay the time for operation may be lost. Of course there is the objection that the prominence of the cicatrix and the ectasy of the anterior hemisphere only show an increase of tension in the latter, that the excavation of the disc may not occur, and hence that delay may be advantageous. Still, even supposing that we are certain that the increase of pressure is limited, its effects on the anterior portion of the eye will not allow expectant treatment. We may lay it down as a general rule, that the dangers of iridectomy, especially the tendency to cyclitis, increase in proportion to the corneal ectasy. The increased diameter of the cornea is attended by no corresponding enlargement of the crystalline system, thus the zonula is stretched and becomes defective, the position and probably the circulation of the ciliary organs is rendered abnormal; it is a matter of experience that under these circumstances the most accurately performed iridectomy may be fol-

lowed by escape of vitreous, and as a consequence or not of the latter, by cyclitis; the latter is not always immediate, but occurs even after weeks or months. These dangers are trifling when the cornea is but little enlarged, but they increase very rapidly with the projection, cause enough for carefully tracing the commencement, and not postponing the treatment. For example, to delay in leucoma adhærens after ophthalmia neonatorum till the increased tension can be estimated by the touch, would usually be to wait till too late. *Every permanently projecting cicatrix should incline us to operate. Enlargement of the corneal diameter and of the anterior chamber are most decided indications.*

According to circumstances, paracentesis of the anterior chamber, iridectomy, excision of the cicatrix, and removal of the lens, may be required. The puncture has a permanent effect, only when the excessive secretion is due to transitory causes, for example in partial styphyloma irritated by external agents or before cicatrization is complete. Frequent and rapid repetition of the puncture can scarcely be recommended, owing to the tendency to suppuration in the cicatrix. Excision, without removal of the lens, is adapted principally for small prominent cicatrices of unhealthy structure, to the irritation of which we can refer the local tension, for ceratocele, for cystoid cicatrices over little prolapses of the iris, &c. Iridectomy may give brilliant results at almost any stage, from simple projection of the cicatrix to fully developed secondary glaucoma, but we cannot foretell its effects with certainty. It may effectually relieve the tension and cause the projection to recede to the normal level in cases of very large staphyloma, whilst it sometimes fails to give relief in apparently far more favourable examples. The reason is that the operation does not act directly on the special causes, the irritation of the cicatrix or the position of the lens, but only indirectly on conditions of varying importance. It diminishes the secretory irritability of the iris, and thus often enables it to resist the existing injurious agents. The morbid influence is too great at other times, especially when the oblique position or protrusion of the lens keeps up the irritation of the cicatrix. Then the lens should be removed (through a transverse incision or a partial excision of the cicatrix), at all events as soon as it appears that iridectomy does not give permanent relief.

We must not forget that the operation is attended with some risk; besides the danger of loss of vitreous and consecutive cyclitis already mentioned, it promotes the tendency to purulent softening, already present in many forms of prominent leucoma.* Purulent panophthalmitis may be the ultimate result, notwith-

* This is a reason for postponing iridectomy, in many cases, till the original process has completely ended. Such delay should be, indeed, the rule in central phagedenic suppuration.

standing the greatest attention paid to the after-treatment. In conclusion, we may say that iridectomy is of the utmost value in these conjunctures, and is less dangerous than excision of the cicatrix or extraction of the lens, yet it by no means overrules the whole course, and is not so free from risk as in simple inflammatory glaucoma.

Cornea globosa.—The operation is of far less value in the forms that are originated during foetal life. They become further developed after birth, and, even at an early period, are often followed by glaucoma: they pass under the names of cornea globosa, staphyloma sphericum pellucidum congenitum, hydrops camerae anterioris congenitus, hydrophthalmus congenitus. It is possible that these affections, even when they seem uncomplicated, are really due to an abnormal state of the internal membranes (latent choroiditis), which becomes evident only at a later period by opacities of the media, irregular pigmentation, &c. As, however, the cornea or its nerves may undoubtedly originate secretory irritation, we must admit the possibility that for a time the corneal expansion may be the only change. (Vide the Berliner medicinische Wochenschrift, 1868, No. 24, Ueber Keratoconus). Both eyes are usually affected, though one sometimes escapes for a long time or even altogether the secondary disease; it is, besides, by no means very uncommon for the primary disease to occur only on one side.

It is generally recognised that these are not promising cases for operative treatment. As long as there is simply enlargement of the corneal diameter and of the anterior chamber, before the occurrence of opacities of the media or excavation of the disc, the sight is often relatively good, so as to contraindicate any treatment attended with risk; consecutive changes may never occur, at all events the time of their advent cannot be predicted. Once present, they often progress so slowly, and iridectomy is attended with so much danger, that we hesitate to operate. We have already mentioned how intolerant of such treatment are large corneal ectasies; this is still more true of cornea globosa and allied conditions. Owing to the constant presence of defects in the zonula and the predisposition of the vitreous to infiltrations, iridectomy is always liable to excite dangerous, even purulent, processes in the vitreous, or, as in the other varieties of corneal ectasy, an insidious form of cyclitis; finally, when there is decided glaucomatous tension, there may be choroidal hemorrhage. Hence, iridectomy is only dubiously indicated where the disease is making rapid progress through the increase of pressure, and both patient and physician are inclined to try a remedium anceps. Nothing will be attempted in the vast majority of cases; where gradual deterioration is due to the ectasy, paracentesis may be used occasionally to check it,

a proceeding from which I have only exceptionally found benefit, but which is less dangerous than iridectomy, though not absolutely innocuous.

Riband-shaped Opacities of the Cornea.—I shall finally mention a form of glaucoma which must be known to many practitioners, though it has not been satisfactorily described, and which is doubly interesting, by its mode of development and the possibility of accurately tracing its origin. For a long time I was doubtful whether it sprang from the cornea or from the iris and ciliary organs. Everyone must have seen whitish-grey dotted opacities, running directly across the cornea (corresponding to a partial opening of the eyelids); they are riband-shaped, $1''$ — $1\frac{1}{2}''$ broad, peculiarly dull, and accompanied by chronic iritis, closure of the pupil, calcification of the lens, atrophy of the globe, or glaucomatous hardness. It is certain that such opacities occur also in old irido-cyclitis, but we are not here concerned with those so derived; exactly the inverse course takes place in a smaller proportion of cases.

For a certain time there is a simple *corneal affection*, without any complication; not till months, more often years, does the globe become hard, a hardness usually accompanied by posterior synechia, a steady deterioration of vision, and other symptoms, just like those in glaucoma. Ultimately the lens becomes opaque and calcified; the tension continues great; sometimes acute irritations are followed by phthisis bulbi, the result being thus exactly the same as after the inverse course from irido-choroiditis.

The patient does not generally notice the very commencement of the disease, nor does he consult a medical man till there is a little dazzling or impairment of vision. There is then found some photophobia, and a peculiar dulness of both the inner and outer side of the cornea; the opacity extends from the periphery towards, though it does not reach, the centre;* were the upper and lower edges prolonged forwards, they would include a transverse, riband-shaped space. Its colour is usually grey, with a shade of yellow or brown; it is most intense towards the margin of the cornea, somewhat less towards the upper and lower edges of the opacity, least towards the centre of the cornea where it gradually fades away; it is peculiarly dull, and hides, to an unusual degree, the iris. The epithelial surface is for the most part smooth; the magnifying glass shows that the opacity is composed of innumerable delicate greyish points. During this first

* The opacity is sometimes very great on one side at a period when it is scarcely noticeable on the other. Its upper and lower edges are occasionally not quite parallel, but converge slightly towards the centre of the cornea, yet even then the edges of the opposite opacity tolerably correspond, so that ultimately the transverse band formed by the complete opacity would converge a little towards the nose or temple.

stage the progress is extremely slow, many months being required to cause any perceptible difference; the disease may occasionally be quite stationary. And yet the two opacities very gradually approach one another, so that the resemblance to the form of a ribbon steadily increases. The most striking peculiarity besides the form is the extreme loss of transparency; the colour is a dirty greyish-white, or inclining to a yellowish-brown; the surface remains generally smooth. The whole appearance excites the suspicion of an inorganic deposit; I have, in former days, many times erroneously imagined that an ointment containing some metallic salt had been used. The disease appears to always affect both eyes, though in an unequal degree, and not at the same time.

Now, it is quite certain that before or at this time, the disease is totally *free from any complication*. The pupil reacts perfectly to light, and can be readily dilated by atropine. The vision is exactly proportional to the optical condition; it is improved by proper shading, the stenopaic slit, or by atropine and stenopaic convex glasses, to a greater degree than in older infiltrations of equal extent, owing to the exact circumscription of the opacity and the absence of irregular astigmatism from any abnormal curvature. The ophthalmoscope shows that the media, internal membranes, and optic disc, are perfectly normal. The most careful palpation can discover no trace of increase or suspicious variation of the tension. In addition to the opacity, there is only a greater tendency to pericorneal injection and to lachrymation when the eyes are exposed to the light, states clearly due to the corneal irritation and the dazzling from the diffusion of light by the opacity. To repeat, there is in this stage *disease of the cornea alone*.

After a time there are certain changes; occasionally the tension increases, the pupil becomes sluggish and somewhat dilated, and the disc excavated, as in glaucoma simplex; more often the iris becomes discoloured, no dilatation can be produced by atropine, the aqueous is periodically clouded, posterior adhesions are formed in a most insidious manner, though with some increase of the vascular irritability of the affected eye; very soon they not only correspond to the sphincter, but to the whole of the posterior surface of the iris. In company with this chronic iritis, the tension increases, and all the symptoms of secondary glaucoma make their appearance. Sometimes the anterior chamber is shallower, sometimes it keeps its normal depth, probably owing to the increase of pressure being equal to that in the vitreous space. Whether the iritis intervenes pathogenetically between the corneal disease and the glaucoma, or whether both are due directly to the corneal affection, cannot be decided. The second alternative cannot, of course, be rejected, because, as already mentioned, glaucoma arises in certain cases without the intervention of iritis.

The only change in the cornea during this later period is caused by the appearance of many intensely white, perfectly opaque spots. They somewhat resemble lead deposits, still more the calcifications in irido-cyclitis, with which their structure appears to be identical, so far as there has been an opportunity for microscopical examination. Any further changes in the eye are simply those of secondary glaucoma, and require no detailed description.

I have found very great and permanent benefit from iridectomy; but it must not be delayed too long, because the formation of synechiæ, soon extending along the posterior surface of the iris, will endanger the result. Wherever a large piece of iris, reaching to the periphery, could be excised, the result was very satisfactory in respect to the tension and the whole further course.

I am inclined to believe that the operation exercises some influence in preventing the spread of the corneal disease, though my cases are not sufficiently numerous to demonstrate it. The opacity always remains limited, and does not destroy vision, when the secondary changes are prevented. I have not seen any damage from the operation in eleven eyes on which I have performed it, neither increased sclerosis nor disintegration of the opacity, nor cyclitis, as after many of the complications previously mentioned. I employed the peripheral linear incision, when there were already extensive posterior synechiæ, as indeed I always do under such conditions. The objections which I formerly raised (A. f. O., xiv, 3, p. 147) to its general use in glaucoma, are not valid here, for the tension increases very slowly, and the anterior chamber never becomes extremely shallow. I have been obliged in a single case to make a second pupil diametrically opposite, in order to reduce the tension sufficiently; there were already very extensive pigmented neoplasms on the posterior surface of the iris.

The Iris.—Some brief remarks will be sufficient, as the importance of the iris is generally recognised in respect to the origination of glaucoma.

Purulent iritis, running its usual course, sometimes does not modify the tension at all, sometimes excites a very transitory increase followed by decided diminution, even by permanent atrophy of the globe; its influence, indeed, depends on its degree. Hence it plays scarcely any part in the production of glaucoma, though its residua, the posterior adhesions and collections of retro-iritic fluid, may give the impetus in question.

The *common plastic iritis* usually modifies the tension but little, the increment of the disease being attended by a very transitory and slight increase. Hence glaucoma rarely accompanies the primary attack; it occurs at a later period, when adhesions, projection of the iris by fluids, &c., have been left.

There are, however, exceptional cases. The pupil contracts and generally presents an obstinate resistance to mydriatics from the beginning; there is great pericorneal injection, in which, besides the anterior conjunctival vessels, the venous trunks of the episcleral network take an active part. The aqueous is not much clouded, and the cornea little affected in comparison with typical glaucoma. Yet the anterior chamber contracts, the globe hardens, and the vision sinks excessively; untreated, the optic disc becomes excavated.

I have scarcely ever observed this form, except in the second eye, after the other had been long glaucomatous; I cannot say, owing to the rarity of the cases, whether this is simply due to accident. Sometimes there was already an excavation of the disc (glaucoma simplex), and the iritis indicated, as it were, the transition to the inflammatory form. In other cases the eye had been previously perfectly healthy. In short, the only differences in the symptoms from those of typical inflammatory glaucoma, are the contraction of the pupil and the slighter haziness of the aqueous humour. Plastic iritis takes, so to say, the place of the usual serous form; with the latter the pupil is free, and there is no obstacle to mydriasis from compression of the ciliary nerves; the condition of the aqueous varies in a similar way, according to the form of iritis. The treatment is that of typical inflammatory glaucoma, iridectomy at the earliest period with the precautions necessitated by adhesion of the pupillary margin.

Serous iritis is of all inflammations of the iris the one most connected with glaucoma. This inflammation is characterised by diffuse cloudiness of the aqueous and of the posterior surface of the cornea, by increased tension in the anterior chamber, with little or no plastic exudation, and with no notable parenchymatous change. It shows, *per se*, a tendency to increase the pressure in the vitreous space. A part, but never more than a part, of the pressure may be removed by the recession of the iris and lens, the anterior chamber often becoming very much deeper. If there is no change in the position of the iris, it must be admitted—and it may be proved by palpation—that the tension is increased proportionally in the vitreous space. We must admit that there is always some slight increase of the ocular tension; that this is followed by glaucomatous symptoms in only a certain proportion of cases, notwithstanding the long persistence of the disease at its acme, is due to the age of the patients, for we know how relatively slight the tendency to excavation is in youth.

When, however, the tendency persists or is unusually great owing to continuance of the irritation, as when it is caused by rupture of the capsule or by dislocation of the lens, serous iritis ends in glaucoma at any age, even in early childhood. The older the patient, the greater is the risk of this termination; glaucoma should be suspected whenever with symptoms of irritation the

aqueous becomes clouded and the pupil becomes sluggish in elderly people. If, in addition, the anterior chamber is flattened and the pupil dilated and fixed, the diagnosis may be made without palpation; for as inflammatory cloudiness of the aqueous is attended by increased tension in the anterior chamber, the iris must be pressed back and the chamber be deepened, providing the tension is normal in the vitreous space. If, on the contrary, the iris is pushed forwards, the tension behind it must be very decidedly increased. The pupil may be sluggish and slightly dilated in simple serous iritis, yet, as the peripheral portions of the ciliary nerves in the iris itself are alone compressed, it is never so widely dilated and fixed, as from glaucomatous tension or compression of the ciliary nerves throughout their whole intra-ocular and intrascleral course.

Serous iritis is not a simple, genuine form of disease in the majority of cases. Its most common complication is serous chorioiditis with diffuse lesions of the vitreous or equatorial chorioiditis (cyclitis) with membranous, flaky opacities of the vitreous body. When so complicated, the process is subject to other laws, to which we shall return when treating of the choroid. As to the iritis complicating a corneal affection, as keratitis pannosa, cornea globosa, we have already explained how the primary affection influences the course and treatment. Glaucoma, due to serous iritis, affects one or both eyes, according to the causes.

Iridectomy is generally indicated in serous iritis with glaucomatous tension. Its results are satisfactory, unless owing to complications. When the iritis is accompanied by extensive disease of the vitreous, ectasies of the cornea, &c., the prognosis depends to a great extent on the complications.

Posterior synechiae, the effects of iritis, are very often the cause of secondary glaucoma. As a general rule, we may say that the danger of ultimate increase of tension is proportionate to the extent and number of the adhesions, though occasionally glaucoma is excited by perfectly circumscribed, pointed synechiæ. The degree of danger is also influenced by various conditions, such as the age, with which it increases. On the other hand, the tension may remain normal throughout life; this is, indeed, numerically speaking, the rule even when the adhesions are numerous and extensive. As soon, however, as they *perfectly encircle* the pupil, causing exclusion,* the tension seems to me to increase almost invariably. There must, of course, be no mistake; the most careful examination will sometimes fail to show minute apertures, through which fluid will pass. In my opinion, *projection of the iritis by retro-iritic fluid is the only sign of complete exclusion*. When this state is clearly shown by the well-known prominences of the iris, glaucoma is sure to ulti-

* For explanation of this term, see Sydenham Soc. Monographs, 1859, p. 257.—T. W.

mately occur, and the patient is fortunate if it is not already present. This important fact leads us to the principle that the operation should be performed in cases of circular synechia without hesitation, even when the vision is said to be stationary,* whilst at earlier stages of the disease the operation is not absolutely necessary to prevent destruction. Glaucoma from synechia posterior, just as the primary disease, affects very often one eye, often enough, however, both eyes.

The effect of iridectomy is perfectly satisfactory in this species of glaucoma, both as to tension and vision; the diametrically opposite piece of iris must, however, be excised sometimes, in order to complete and secure the result when the adhesions are very extensive; we shall again refer to this point. The acuteness of vision will depend on the optical state and the degree of previous excavation of the disc.

An objection is sometimes raised to iridectomy, inasmuch as eyes with *congenital coloboma*,† or on which the operation has been performed for optical reasons, are in no way exempt from glaucoma. Such reasoning could certainly influence only those who have paid little attention to the pathogenesis of the disease and the effects of the operation. We have often pointed out that, in secondary glaucoma, iridectomy does not usually act in the least on the primary cause, and that it has a beneficial influence on the succession of morbid states only by diminishing the secretory irritability. Whether the effect is satisfactory or not, will depend on the power of the primary cause. If a congenital coloboma is complicated with chronic choroiditis and disease of the vitreous, or with displacement of the lens, as not unfrequently happens, the operation, however well performed, will often fail to neutralize such active causes; we must also remember that a congenital defect has very often not the same qualities as one produced by an operation for glaucoma. We may say the same in regard to previous iridectomy; such states as leucoma adhærens, synechia posterior, may necessitate the operation for optical reasons, and at a later period cause increase of tension, over which excision for the simple transmission of light may not have sufficient power. Finally, a previous iridectomy may itself promote increased tension, especially when the iris is strangulated in the wound. (*Vide infra*.)

The lens—*simple cataract*: it is still doubtful whether simple structural change of the lens without displacement or rupture of

* If the patient still sees relatively well, as not unfrequently is the case, it cannot be denied that iridectomy causes a little impairment (without stenopaic apparatus). A portion of the pigment-layer usually remains and acts unfavourably on the optical condition, even when the proper practice of excising the upper part of the iris is followed.

† I have also twice found glaucomatous excavation in total congenital irideremia. It was clearly due to equatorial choroiditis with disease of the vitreous.

the capsule can occasion glaucoma. I have indeed seen five times (in four individuals) glaucoma supervene during the maturation of a previously simple cataract. Careful examination had proved the absence of any complication when they consulted me; owing to the opacity of the cortex being incomplete, they had been advised to wait for some months or half a year. Acute glaucoma, presenting perfectly typical characters, broke out during this period, four times indeed in a most violent manner.* I cannot say that there was, during maturation, any particular swelling of the cortex, or any other condition having special reference to the glaucoma. I am the less inclined to admit any causal connection, because the number of cases is trifling in comparison with the total amount of cataracts observed before their maturity. Either the combination was accidental, or both affections were due to one and the same cause; for with our ignorance of the ultimate causes both of cataract and glaucoma, we cannot say that one and the same anomaly, disease of the vessels, or what you like, may not, under certain conditions, sometimes excite the one, sometimes the other disease.

The acute inflammatory character of the glaucoma is not favourable to the view that it arose from swelling of the cortex. Most cases of secondary glaucoma, except perhaps those from intra-ocular tumours, present symptoms of simple increase of tension without haziness of the media (glaucoma simplex), or of subacute inflammation (iritis or irido-choroiditis serosa remittens with increased tension). A fulminating inflammatory attack is preceded, almost without exception, by one of these forms. In our cases the attack was markedly inflammatory (four times very sudden), as already mentioned, whilst there had not been the least anomaly shortly before, when the eyes were examined (especially as to their tension) with reference to a cataract operation.

Displacement of the lens is indisputably very often the cause of glaucoma. So long as the capsule is entire, the secretory irritation is due partly to stretching of the zonula and indirectly of the ciliary organs, partly to direct molestation of the iris and surrounding parts. We know with respect to congenital dislocation of the lens, that glaucoma is no uncommon sequence. Traumatic glaucoma is also due, to a great extent, to the displace-

* Iridectomy was performed on all five eyes; the operation for cataract on four after a long interval, thrice with perfect, once with partial success. I am decidedly opposed to the performance of both operations at the same time, because escape of vitreous cannot be always avoided under these circumstances, and would be very likely to be followed by serious choroidal hemorrhage. In one of the four individuals, acute glaucoma attacked successively both eyes at an interval of five months in an almost congruous way, shortly before the cataract was mature.

ment of the lens. (*Vide infra.*) We meet, however, with perhaps the best example of this cause where the attachments of the lens are gradually destroyed through intraocular disease, such as softening of the vitreous, and where there is no increased tension until the lens is displaced to a certain degree. Finally, there are the cases in which, after perforation of the cornea and partial rupture of the zonula, but without that of the capsule, the lens is placed obliquely, pressing against a cicatrix, or after entire destruction of the zonula prolapsing into a staphyloma—generally recognised conditions on which we made some remarks when treating about projecting cicatrices of the cornea.

It is very interesting to follow in detail the development of glaucoma after displacement of the lens. It would almost seem as if trifling relaxation or destruction of the zonula, accompanied by slight variations of position or abnormal mobility (tremulousness) of the lens, presents more risk of increased tension than where the lens is entirely separated from its normal attachments and assumes an entirely fresh position. Wandering lenses—we except those that are calcified, for then there is always further serious disease—usually excite glaucoma, only when they press the iris forwards, or are strangulated in the pupil or between the cornea and iris. The greater danger of partial dislocation is probably owing to the constant stretching of the rest of the zonula and indirectly of the ciliary organs.

The symptoms are sometimes those of glaucoma simplex, more often of remittent serous iritis with increased tension. Very often the aqueous becomes clouded or any existing glaucoma becomes exacerbated, when the lens assumes a certain position, as when it pushes the iris forwards. One or both eyes are affected, according to the existing causes.

It is extremely difficult to give a satisfactory account of the treatment. Nothing can usually be expected from puncture of the anterior chamber; thus the indications are divided between removal of the lens and iridectomy. Both operations are attended with danger, and require the fullest consideration. The escape of vitreous cannot be avoided, for the anterior chamber freely communicates with the vitreous space, and the tension is increased. But any such escape is very liable to be accompanied by deleterious intra-ocular hæmorrhage when there is glaucomatous tension. Of the two operations extraction is decidedly the more dangerous, and iridectomy should therefore be preferred whenever it offers any prospect of success. It answers generally when the lens is not much displaced; when, for example, it presses a part only of the iris forwards. By excising this piece, we not only annihilate the secretory irritation hence arising, but effect important changes in the adjacent ciliary tissues, and thus oppose the tendency to glaucoma, though its primary cause remains. Chloroform is to be strongly recom-

mended, for muscular pressure much increases the danger. The greatest care must be taken that the internal wound is placed as peripherally as possible; it diminishes the risk of the vitreous, which passes into the anterior chamber, pressing the iris back and impeding its prolapse or seizure, as happened to me many times in my earlier practice. Every precaution should be observed after the operation, especially in regard to bandaging. Mishaps, as cyclitis or even retinal separation, may occur after the most successful operation; prudence is therefore necessary in respect to our prognosis. We may say by way of summary, that the majority of cases can be successfully treated by well-performed and carefully-planned iridectomy, whilst in the remainder the operation will be followed by dangerous consequences or not have sufficient effect.

Extraction is our resource, when iridectomy fails or when the lens is entirely separated from its attachments. The risk of loss of vitreous and consecutive cyclitis is far greater than with iridectomy.

We should make it our rule to attempt the extraction of both lens and capsule; when, however, the lens is in the anterior chamber and adheres to the posterior surface of the cornea, as I have often found it when the dislocation dated from the earliest period of life, the better plan is to pass the knife directly into its substance at the place of adhesion, so that it may immediately fill the wound and prevent premature exit of vitreous. I have sometimes avoided in this way any loss of vitreous. Each case has, however, such peculiarities, that it is impossible to lay down any general regulations as to the manner of extraction. A linear incision is most advantageous, all the more because it does not necessitate excision of the iris; it should be so placed as to secure as much as possible the passage of the lens, and to prevent its recession or sinking in the vitreous body. Of course we are not here referring to calcined lenses which have partially or entirely passed into the anterior chamber, and which can usually be extracted without difficulty; they result from long-continued irido-cyclitis, the eyes being blind and far more often atrophied than glaucomatous.

Wounds of the Capsule.—Swelling of the lens after this injury is very liable to endanger the eye by increasing the tension. Both discision and traumatic cataract are more prone, for various reasons, to excite glaucoma in the old than in children or young people. The lens becomes harder with advancing years; there is more secretory irritability, and excavation of the disc is produced by less degrees of tension. We find in cases of traumatic cataract considerable increase of tension (with iritis serosa) continue for weeks, even months, in children without damage to the nerve, an exemption scarcely ever observed in adults or the old. These reasons, not to mention the slow absorption of the nucleus

and the great frequency of plastic reactions, must make us more and more reticent in the use of the needle, as the age recedes from childhood. A very little swelling of a few fragments will excite glaucoma in the old, whilst, even when great and general, it generally has no such effect in the young, providing the posterior surface of the iris is not compressed for any long time.

The passage of fragments into the anterior chamber readily excites slight pericorneal injection, hyperæmia of the iris, or even plastic suppurative iritis, but not increase of tension. The latter is always the effect of pressure on the posterior surface of the iris by the swollen lens, hence *projection of the iris* towards the cornea announces the danger, and to it we must specially attend in regard to treatment. Secondary glaucoma occurs in a like manner after reclinatio; the effect is more pernicious, owing to the inefficiency of our means of treatment. Whilst the glaucoma after discision and traumatic cataract assumes, almost without exception, the form of serous remittent irido-choroiditis, we not unfrequently see after reclinatio, when the ciliary body and anterior portion of the choroid are principally concerned, glaucoma simplex, holding a very insidious course; this explains how many of the older authors, unassisted by palpation and the ophthalmoscope, considered these to be simply cases complicated with amaurosis. The tension may again diminish as the lens is absorbed, and thus the process be arrested. We sometimes notice many alternations of tension in this form of glaucoma, but then the media usually become temporarily clouded during the paroxysms of increased pressure.

The recognition and correct treatment of glaucomatous tension after injuries of, and operations on, the lens, are of the greatest practical importance. Almost as many eyes are lost after penetrating wounds by these secondary processes as by the original injuries. Proper indications and well-adapted modes of operating enable us to avoid in discision, with rare exceptions, dangerous degrees of swelling. The limitation of discision to early periods of life, the previous performance of iridectomy at the upper part in certain cases, the abandonment of the scleral operation, have had decided influence in preventing secondary glaucoma. Only one of the many reasons given for the exclusive use of keratonyxis is decisive, but this it is fully. I refer to the circumstance that the size of the capsular wound, on which the degree of swelling essentially depends, can be exactly estimated in this way, but not at all in scleronyxis. The swelling may exceed what the eye will bear, through no fault of the operator, in exceptional cases when the wound is torn more open through imbibition (in zonular or posterior polar cataract).

I generally advise not to act too hastily when the lens swells in children after discision or injury. I think that the usual

treatment is often erroneous in this respect. Children or young people can bear even considerable increase of tension for a certain time without danger; a second operation, unnecessarily performed, may readily end in an imperfect result or even failure. Besides the tension and allied symptoms, ciliary neuralgia, partial iridoplegia, &c., I always put great reliance on bulging of the iris. If the latter is entirely, or almost entirely, absent, the treatment should be expectant, all the more, the younger the child. Of course there should be no delay if glaucoma exists or is distinctly commencing. The indications are divided between simple iridectomy, extraction, and a combination of the two. The lens should always be extracted in children by a simple linear incision or by the modified linear operation, for by the time there are such dangerous results it is always sufficiently soft throughout to pass through even a small linear aperture. In patients that are older, and where the tension is perhaps due to partial swelling of the lens, it is far the best plan to excise the corresponding piece of iris, extraction being performed, if necessary, at a later time. The best incision is generally the peripheral linear one, when the patients are past their early youth, and the whole lens is at all events in process of swelling.—The result is usually quite satisfactory, providing the glaucoma is not far advanced,* though care in discision is always the best plan of securing good results. Iridectomy will very rarely arrest glaucoma after reclination: removal of the lens is attended by great danger, though, if possible, it gives the best chance.

Aphakia.—I may add a few remarks on absence of the lens. Some time ago it was often asserted that the lens had much influence over glaucomatous tension, and that its absence secured a certain immunity. In accordance with this view, extraction was earnestly recommended in the place of iridectomy; the emptiness of these suppositions was soon shown, cases of glaucoma being seen in increasing numbers where there was from congenital disease only a remnant of the lens or where it had been removed for cataract. Glaucoma may, indeed, have commenced in some of these cases, owing to swelling of the lens, and after absorption have remained as a fully developed disease; it has, however, been seen tolerably often after extraction, when, for example, the iris had been strangulated; it may also be excited by the operation for secondary cataract, as Bowman has pointed out (see the Ophth. Hosp. Rep., vol. iv, p. 365); to the latter we shall have to refer again. Finally, it has been seen in all kinds of injuries, accompanied by loss or followed by absorption of the lens. Hence it is clear that its absence does not give even partial immunity, and that its removal diminishes the ten-

* The phosphenes are of practical value in testing the field of vision when the lens strongly diffuses light so as to interfere with the usual method.

dency to glaucoma, only when there is some such state as dislocation of the lens or rupture of its capsule.

The Choroid—Acute Plastic and Purulent Choroiditis (as well as genuine, purulent hyaloiditis) do not increase the tension, except very temporarily during the stage of increment; the acme is immediately followed by very rapid absorption of the ocular fluids and diminished tension or phthisis bulbi.

Serous Choroiditis.—We have mentioned on various occasions that acute inflammatory glaucoma must be considered to be a serous choroiditis. The question remains, whether the increased tension (or special irritation of the secretory nerves) is the only symptom that distinguishes it from other forms of serous choroiditis. We see, indeed, tolerably often choroidal affections with but slight tissue-changes, characterised principally by cloudiness of the vitreous, and accompanied by iritis of exactly similar nature. There seems to be a qualitative difference between this and the glaucomatous form in the kind of opacity of the vitreous, in addition to the tension. The nature of the cloudiness of the vitreous in acute glaucoma is far from being accurately known, yet it is clear from the result of treatment that it may very rapidly and totally disappear (it is probably quite diffuse), that the proper structure of the vitreous is unaltered even after its persistence for a long time, and that the hyaloid is usually not destroyed. On the other hand, in the ordinary non-glaucomatous form of serous irido-choroiditis, the vitreous opacity, though partially diffuse, is always produced in some degree by circumscribed products, the structure of the vitreous suffers (fluidification), the septa of the hyaloid and the attachments of the lens are gradually destroyed when the disease is protracted and attains a high degree. The normal transparency is restored completely in only the minority of cases, and then slowly; yet, though we admit that there are other differences besides that of tension between these forms of inflammation, their allied nature is shown by the tolerably frequent development of secondary glaucoma in the ordinary serous variety.

We often find that serous choroiditis occasions no notable alteration in the tension throughout its course, whilst in other very common cases, attended or not by subretinal exudation, the eye is softened, and finally there is even phthisis bulbi. On the other hand, there are cases with positive variations of pressure, usually accompanied by periodical increase of cloudiness in the vitreous, and, when there is iritis, of the aqueous also, and ending in a permanent increase of tension with its various consequences. We cannot possibly say why there is sometimes the one, sometimes the other tendency, whilst both forms seem to originate in the same way. Something is due to age, and sometimes the tendency is decided by the lens, when it is mobile or permanently displaced through destruction of the zonula. This, however, is

far from exhausting the subject, and we are compelled to admit great individual differences in the secretory irritability, in order to explain the divergent course.

What passes at present under the name of serous choroiditis is a complex of different diseases. There are in the first place cases characterised principally by diffuse, only here and there delicately membranous, opacities of the vitreous, whilst the symptoms of irritation are very slight or almost entirely absent. Nothing can be discovered in the choroid itself by the ophthalmoscope, and even at a later period, when the vitreous has considerably cleared, nothing of importance. Were it not for its frequent combination with serous iritis, to which it has the closest analogy, we might readily consider it a genuine disease of the vitreous (chronic hyaloiditis), instead of of the choroid. It frequently causes a dotted posterior polar and cortical cataract, sometimes found as the effect of the disease long after the vitreous has recovered its transparency, just as dotted opacities are seen in the equatorial zone of the lens after serous iritis. The vitreous usually becomes again perfectly clear, though slowly in comparison with glaucomatous choroiditis. The zonula suffers but partially, if at all. Then there is a very general opacity of the vitreous, which is found in company with slight changes in the choroid near the equator; it is accompanied by distinct, usually remittent, symptoms of irritation, and is partly diffuse, partly composed of membranous shreds and flakes. The choroidal alterations may escape notice at first, but they appear more distinctly as the opacity becomes circumscribed and the choroidal pigment becomes more involved. Perfect restoration of the vitreous is rare; the septa of the hyaloid, sometimes also the zonula, atrophy when the disease persists. Iritis is the usual accompaniment, more often following, however, than preceding the disease of the vitreous; it is of a mixed, rather plastic than purely serous nature (posterior synechiæ are formed). Every possible variety is found between the two forms of choroiditis, a reason for including them under one denomination at present. Both may originate secondary tension, though the former type seems far more closely related to glaucoma; the latter ends much more commonly in retinal separation and phthisis bulbi, rarely leading to glaucoma, except in advanced life and when the lens has been displaced.

I must here mention an occurrence of importance, both in respect to choroiditis and also to some kinds of glaucoma simplex (*Vide infra*). It is by no means very uncommon for eyes affected with posterior polar and cortical cataract, but without a trace of disease in the vitreous, to be affected with glaucoma. Now I think there is a great probability that these cataracts result from previous choroiditis, and that, although the vitreous has cleared, the state of the choroid continues abnormal

(choroiditis latens) after the apparent termination of the primary disease; such latent disease is in my opinion the cause of the secondary glaucoma.*

Glaucoma due to serous choroiditis generally affects both eyes. Repeated paracentesis is sometimes successful; of this I had a very marked example last summer. An old lady suffering from diffuse disease of the vitreous and equatorial choroiditis, became subject to attacks of glaucoma. Almost every afternoon the aqueous became much clouded and the tension most distinctly increased, whilst for many hours after she awakened the one was perfectly clear and the other completely normal. Three days passed without an attack after the first puncture of the anterior chamber,† a week after the second, and after the third there was no return for many months, during which she was kept under observation. Paracentesis is preferable to iridectomy, but should be repeated only when the result of the first trial is satisfactory. Iridectomy is our principal means of treating continued increase of tension; on this it exercises usually a permanent effect, unless the lens is already displaced, yet in exceptional cases fresh effusions in the vitreous excite a return of the tension. In the latter event repeated paracentesis should follow the iridectomy, or a second, diametrically opposite, piece of iris be at once excised. I need scarcely mention that the prognosis is dubious even after restoration of normal tension, as the original disease may lead to destruction by progressive synchysis of the vitreous, or by secondary cataract, dislocation of the lens, and separation of the retina. No general answer can be given to the question whether iridectomy also acts beneficially on the choroidal disease. Such an effect must be admitted where

* Everyone knows that operations on eyes with posterior polar or cortical cataract are liable to be followed by unusual reactions, probably owing to the continuance of choroidal irritation. There are other reasons also for admitting such a quasi latent affection. I may note especially the appearance ultimately of choroidal changes in regions of the fundus, which correspond to earlier functional alterations. When we remember how much our diagnosis depends on the pigmentation, we may imagine how there may be many important deviations from a normal state, without any immediate ophthalmoscopic symptoms.

† I may here say a few words about the method of repeated paracentesis recently recommended, especially by Sperino. Its effect is decidedly beneficial in chronic choroiditis with participation of the vitreous. I have not repeated the puncture so soon as is recommended by Sperino, but have left intervals of three or four days, sometimes a week. A single puncture may originate progressive improvement, or cause other and previously unsuccessful treatment to act favourably. Sperino is, in my opinion, right in attributing importance to the form of the paracentesis needle; the one used by him has no angular projection, and is far sharper pointed than that in ordinary use. I must also urge strongly on my readers not to locate the puncture near the sclero-corneal boundary. Adhesions between the iris and cornea may be avoided with certainty by entering the knife flatwise $\frac{3}{4}$ "', even 1"', within the scleral limit, so as to place the internal wound beyond the reach of the iris.

the vitreous clears decidedly after the operation, a result, however, that is by no means constant. The tendency to fresh effusions appears to be somewhat diminished, yet other means—I specially employ repeated courses of inunction and the seton—are also required.

Thus iridectomy forms an important, though not predominant, part of the treatment when glaucoma arises from serous choroiditis; it is, however, not quite without danger, it may increase the disease of the vitreous, or even be followed by retinal separation owing to intraocular hæmorrhage; plastic cyclitis may also possibly occur.

Glaucoma scarcely ever occurs, after fluid has been effused under the retina in inflammatory processes. The only exception is presented by an extremely rare form of hemorrhagic choroiditis; it is accompanied by bloody effusions into the vitreous and separation of the retina, and it ultimately assumes the characters of hemorrhagic glaucoma (*Vide infra*). I remember only two other cases in which secondary glaucoma attended complete retinal separation. The tension is usually diminished; sometimes it continues for a long time within the normal range.

Forms of chronic choroiditis, which are generally accompanied by little or no change in the external vascularity, but are characterised by ophthalmoscopic appearances in the pigment and stroma, are scarcely ever followed by variations in the tension, and do not favour the development of glaucoma. There is the most inclination to increased tension in the specially equatorial form which is accompanied by floating, not exactly diffuse, but very extensive, opacities of the vitreous, and which is closely allied to the second variety of serous choroiditis previously described.* On the other hand, the proliferations of the pigment-layer or outer retinal layers (choroido-retinitis), which ultimately end in partial atrophy of the retina and optic nerve, do not influence the tension. I may say the same of isolated or multiple exudations on the inner surface of the choroid, which are followed by corresponding changes in the pigment. All the affections of the stroma, whatever may be the grouping of the alterations, and whether the ulterior local atrophy attacks the pigment-layer or not, appear to me to modify the tension, only when complicated with equatorial choroiditis and extensive opacity of the vitreous, or when they are extensions of sclerotico-choroiditis posterior. Two cases in which I have seen glaucoma follow disseminated choroiditis, free from either of these complications, must be referred to accident, just as the similar succession after circumscribed corneitis or cataract.

Sclerectasia posterior, and the accessory forms of *posterior choroiditis*, are often followed by glaucoma. I have adduced this

* The difference consists simply in the pre-existence and greater degree of the choroidal lesions and in the less diffusion of the opacity of the vitreous.

circumstance on a former occasion in explanation of the excessive impairment of vision in many cases of extreme myopia (Vide A. f. O., iv, 2, p. 153).^{*} So long as all posterior ectasies were considered to be caused by sclero-choroidal inflammation, secondary glaucoma was supposed, of course, to arise from the inflammatory irritation spreading to the secretory organs. Now that we consider the primary disease to be due to stretching, though congestion and inflammation have a large share in the subsequent textural changes, the glaucoma will be interpreted in a similar manner. The process resembles, in my opinion, that in corneal ectasies; I incline the more to this view, because the posterior staphyloma involves a region through which important nerves pass.

Glaucoma complicates posterior ectasies, not only when there are extensive inflammatory changes of the choroid, opacities of the vitreous, &c.—results constituting sclerotico-choroiditis posterior in a strict sense of the name—but also not unfrequently when there is only lengthening of the optic axis, thinning of the sclera, diffuse rarefaction of the choroid, including the pigment-layer, in the posterior hemisphere, and circumscribed choroidal atrophy along the outer edge of the disc. The form is in the latter case usually that of glaucoma simplex: the media remain clear, but the tension increases, the disc becomes excavated, the field of vision contracts, generally from the inner side (there are exceptions, thus a vertical contraction from above and below is more common in this than in other affections), the central vision sinks, though usually not till the field is much contracted. This course seems partly due to advancing age; the sclera gradually offers greater resistance to expansion, and besides impeding the venous circulation, compresses and irritates the ciliary nerves as they pass through it. The occasional diminution of the myopia points to some retraction of the membrane. An hereditary tendency is the cause at other times. I have met with two families, where, after a decided increase of the myopia during childhood, this transformation of it into glaucoma took place in a number of sisters constantly between the ages of 12 and 18. I have been unable to find any cause in other cases of moderate myopia, where glaucoma came on during middle age; it is quite possible that the two affections had no causal relation, that the glaucoma was a glaucoma simplex (or a glaucoma ex causa ignota) occurring in a somewhat myopic eye.

Though glaucoma may follow simple sclerectasia posterior, yet I am quite willing to admit, that often, perhaps more often, it does not appear until there is sclerotico-choroiditis posterior in

^{*} My experience was limited. So far I had observed this form of glaucoma almost exclusively in the old; soon after I found that it was not so restricted. I also laid too much stress on the superficial nature of the excavation—we also meet with the deepest and most typical forms.

the strict sense of the words ; I mean when there are choroidal changes exceeding those of simple atrophy from stretching, spreading from, or scattered around, the original centre, choroidoretinitis about the macula, inflammatory opacities of the vitreous, &c. It would indeed be difficult to say how far the glaucoma is due to the expansion, and how far to the secondary inflammation. Whilst in simple ectasy we usually find glaucoma simplex, the second variety is followed, in the majority of cases, by the form of serous irido-choroiditis with periodical cloudiness of the aqueous, and effusions in the vitreous. We must entirely exclude the patients, in whom the glaucoma is due to such results, as dislocation of the lens, equatorial choroiditis with diffuse opacity of the vitreous.

I have already mentioned that the *excavation of the disc* does not always present the typical characters of being produced by pressure ; this is noticed especially where the disc is surrounded by circumscribed atrophy of the choroid, and where there are changes due to posterior choroiditis. The steepness of the edge is the most important character of an excavation from pressure ; it is essentially due to the different resistance of the disc and of the adjacent tissues ; as this difference undoubtedly decreases in posterior staphyloma, so also will the steepness of the edge diminish. Accordingly, in cases of sclerectasia posterior, any excavation reaching to the margin of the disc and presenting a change in the size of the central vessels at this point, must be considered due to pressure, if accompanied by the corresponding tension and functional symptoms. No great trouble will be caused by exceptionally large physiological excavations in the diagnosis, because the existence of posterior ectasy promotes their obliteration. I refer again to this subject, because I have seen many cases during the last few years, in which the existence of glaucoma had not been recognized by most competent medical men, and the best time for operative treatment had been allowed to escape. Of course, we are met by the objection, that if the alteration in the relative resistance can prevent the formation of a typical pressure-excavation, it must delay the production of any genuine interruption in the nerve-fibres and of the corresponding amaurosis. This objection holds good in many cases : thus we often enough find no glaucomatous contraction of the visual field, &c., though the disc is moderately excavated in the manner described. When, however, there are the latter symptoms (contraction of the field, &c.), we are justified in supposing that less than the usual amount of mechanical force suffices to interrupt the functions of the retina.

Central vision is for a long time unaffected, unless the region of the macula lutea becomes diseased ; the nerve-fibres passing to the fovea and its circumference, generally offer greater resistance, and do not suffer in this form of excavation till a rela-

tively late period. This is occasionally shown in a most striking manner; for example, a contraction of the inner side of the field of vision, approximating to the macula, encircles the latter in the form of two horns, one above and one below; these ultimately coalesce so as to divide the field into two parts, a small central and a peripheral temporal portion. This interesting phenomenon is not very often noticed, owing to the rapidity with which the vision, excentrically outwards, becomes impaired, so that only the little central piece is left. The latter stage, lasting for a very much longer time, is again much more often observed.* At other times the contraction, which as it approximates to the point of fixation, becomes stationary for a time in almost all cases, again progresses, and includes the centre of the field, leaving only an excentrical portion functionally active.

Although some excavations in sclerotico-choroiditis posterior do not possess any great depth or steepness, we meet with others of the most typical form. Probably the deepest excavations that are ever seen, arise in this way, especially when the choroid is not much atrophied around the disc, whilst the tunics of the eye are attenuated over the whole posterior hemisphere; the lamina cribrosa possibly offers much less than its usual resistance (the glaucoma was always simple). I have been surprised at the length of time a very deep excavation would exist in some patients without any functional disturbance; this is possibly owing to less resistance of the scleral ring. I still have a French gentleman under observation, on whose left eye I performed iridectomy seven years ago, on account of glaucoma complicating moderate myopia. The disc was even then so deeply excavated in the right eye, that the least functional change would have induced me to operate. At the present time, the excavation is one of the deepest and steepest that I have ever seen, yet the acuteness of vision is 1/1, and the field perfectly normal, so that

* Such extremely small central fields of vision are sometimes observed in glaucoma, when S is tolerably good, both in glaucoma simplex and in that from posterior ectasy. I cannot say whether they are invariably produced in the manner described, or whether they may result from progressive concentric contraction. I have, however, not observed the latter mode. There are in general three ways in which such fields are produced: (1) by progressive concentric contraction; (2) by the production of an intermediate zonular defect, which spreads towards the periphery, and perhaps at the same time towards the centre; (3) by lateral contraction, progressing towards the opposite side of the field, but sparing the point of fixation. The first prevails in retinitis pigmentosa, though the second is also noticed. The most characteristic example of the first is found in a peculiar atrophy of the optic nerve, at all events in its later stages. This disease differs decidedly from the usual progressive form, having the ordinary ophthalmoscopic appearances of white atrophy (at the utmost with some contraction of the central vessels), whilst central vision is unimpaired, even when the field is reduced to a few degrees of angular magnitude. I have hitherto found the third variety only in cases of glaucoma.

it seems as if the eye would still bear this state for some time longer: the tension is constantly increased, though only to a moderate degree.

The adjacent sclera may be included in the excavation; hence there may be one single depression at a certain distance, $\frac{1}{4}$ to $\frac{1}{2}$ mm. from the disc, or there may be a double bend, the one in the sclera, the other at the margin of the disc. The position of the former has no necessary connection with the local choroidal atrophy; it may from accident more or less coincide with it but far more often it is placed nearer the optic disc. When there is only a single bend in the sclera, the steepness and consequently the danger to the nerve-fibres are far less than in excavation limited to the disc; the danger, indeed, seems to be decidedly diminished by a very small strip of sclera being included in the cupping. Finally, there are cases of great elongation of the optic axis and circumscribed choroidal atrophy, in which the sclera recedes in a tolerably sudden manner at a considerable distance from the papilla (2—6 mm.); there may be no genuine excavation of the disc, its level being continuous with that of the scleral excavation. Such cases, accompanied perhaps by partial separation of the retina, have an entirely different nosological signification from glaucoma, even when they present a double bend.

Glaucoma due to posterior ectasy, always affects both eyes, and when successive, has a decided tendency to be symmetrical. So far as I remember, I have always found when it was far advanced in the one, that it was present to a less degree in the other eye.

As to the treatment, I can recommend iridectomy in the strongest manner; it appears to always arrest the glaucomatous process, and to render the non-inflammatory forms free from any injurious consequence. Any existing disease of the vitreous or displacement of the lens will, of course, affect the operation in the manner already mentioned.

I always recommend the operation to be performed at the earliest possible period. I am guided by the following considerations:—Paracentesis has no permanent effect, so no time should be lost with a trial of it. The disease appears never to become spontaneously stationary, after contraction of the field of vision has once commenced. Iridectomy may be followed sometimes by considerable, and for the most part permanent deterioration of central vision, when the contraction reaches to near the point of fixation: nerve-fibres already threatened may be destroyed by the effect of the operation. I have twice seen central pass into permanently excentric fixation after iridectomy, and have failed to discover any corresponding change with the ophthalmoscope; a very small marginal strip of the field, in which there had been faint perception, was lost at the same time.* Finally, the pro-

* I have seen a similar effect after iridectomy, when a posterior ectasy

gress of glaucoma seems to render cicatrisation more imperfect. The very same operation was many times followed by cystoid cicatrisation in only one eye—that first diseased. I remember one case, which I saw with Professor Coccius—it was one of the hereditary cases mentioned above—where panophthalmitis, from purulent disintegration of a cystoid cicatrix, suddenly attacked the worse eye, eight years after the operation. When, however, the operation is early performed, it has a satisfactory and permanent effect, judging by a tolerably large number of cases.

I cannot say what influence iridectomy has at the same time on the posterior ectasy, because secondary glaucoma is usually accompanied by an arrest of the myopia: its influence is, at all events, very uncertain on the inflammatory results of the ectasy, such as the alterations of the choroid, the disease of the vitreous. One effect, however, is most beautifully marked, nowhere indeed better than here, where the patients are generally young; I refer to the increased range of accommodation, a rapid decrease of which was sometimes the first cause for the patient to call in medical aid. Of course, iridectomy does not exclude the treatment of the primary affection; the action of many means is indeed promoted by it. After-treatment, especially with the artificial leech, is advisable, when the tension has been only partially relieved, or when it again somewhat returns.

Retina.—Affections of the retina, infiltrative, degenerative, or functional, have usually no influence over the tension,* as we might expect from the retina being in no way connected with the nutrition of the eye. The attention of ophthalmic surgeons, however, has been called to a peculiar form of glaucoma, apparently arising from this source; I mean glaucoma succeeding retinal hæmorrhage. I cannot give any very exact statistics in respect to its frequency; as, however, I find more than twenty certain cases† noted in my journals during the last eight years, we must admit it to be more than an accidental complication or due to an exceptional course. Most of the patients were elderly, over 50 years of age; three from forty to fifty, and a single one, a little over thirty. Sometimes there was widely-distributed

was accompanied by circumscribed choroido-retinal changes about the macula. A moderately marked central metamorphopsy passed into a distinct central scotoma in one case.

* The two cases, quoted by Laqueur (l. c., pp. 54, 55) as *rétinite glaucomatuse*, are not conclusive. The first case did not proceed to complete glaucoma; the violent neuralgiæ, supposed by the author to be connected with increased tension, again diminished; their nature is uncertain, owing to the vision continuing good and the slight weakness present being sufficiently explained by the retinal congestion. The author himself seems to admit the pre-existence of chronic glaucoma in the second case; what disease of the retina existed, and as S was unaltered, it could be but little, may certainly be better considered the effect than the cause of the increased tension.

† Laqueur (l. c., p. 65) found it 7 times in 268 cases.

sclerosis of the arteries; various functional symptoms or alterations in the retinal vessels pointed to the same affection of the cerebral arteries in many other cases.

The disease commences suddenly with central or excentral scotomata, or even the loss of large parts of the visual field. Very often there is neither chromopsia nor photopsia; sometimes they are most prominent symptoms. The ophthalmoscope shows that this state is caused by retinal hæmorrhages, seated not unfrequently where vessels of medium or large size divide; they may occupy various parts of the fundus, though they are principally located near the disc and macula. They sometimes present a striped appearance, sometimes form irregular spots, but are rarely regularly round as in other diseases (as in the hæmorrhagic diathesis). There are always some large and dark patches, though smaller ones of a paler hue are not wanting; ruptures towards the inner surface of the retina and suffusions under the hyaloid are occasionally seen, even causing at places distinct separation of the vitreous body or hæmorrhagic opacities of the same part. The retinal veins are generally much enlarged. After continuing for some time in the same state, or even after having slightly remitted, there are fresh attacks, sometimes of a mild, sometimes of a serious nature. The extravasations are transformed after a time into whitish-yellow patches, exactly like those in nephritis, except that they are not grouped in the same way. I found in one case even the peculiar dots about the fovea. The walls of some of the retinal vessels may (as already mentioned) have been previously thickened, or they may now become so.

So far we have the symptoms of retinal hæmorrhage from arterial sclerosis with or without secondary degeneration of the tissues; such it may remain for an indefinite period, fresh effusions taking place, whilst the previous ones very gradually disappear, or the hæmorrhagic process may in time end, leaving behind it almost always partial atrophies at the places where the retina has been diseased, more or less persisting secondary patches, an altered appearance of the disc, and considerable functional impairment. In other cases—and in my opinion these cannot be determined beforehand—secondary glaucoma ensues after the lapse of $\frac{1}{2}$ to 6 months from the beginning of the disease. Its form is extremely various; sometimes there is an attack of acute inflammatory glaucoma, perhaps with fresh hemorrhage; sometimes the tension gradually increases (rarely, however, does the eye permanently escape inflammation) or attacks of a more or less acute character follow after a time the increase in tension. The pain is usually very violent, even when the tension is by no means extreme. The opacity of the vitreous is commonly of a hemorrhagic nature; that of the aqueous is often due to the same cause. Left to itself, we frequently find that a violent inflammatory attack is followed by sudden and complete blindness, and

before long by diminished tension. The blindness possibly coincides with a hemorrhagic separation of the retina. I found such to be the state in one case, where enucleation was performed at this stage. Other cases go on to glaucomatous degeneration of the eyeball, staphyloma scleræ, &c.

My statement that glaucoma does not occur earlier than half a month after the beginning of the retinal disease, is drawn from my own experience. Coccius has published a case ("A. f. O.," ix, 1, p. 8), in which glaucoma followed in two days after the supposed commencement of the retinal process. His case is also exceptional in respect to the excellent effect of iridectomy. Possibly the interval was longer than supposed; slight retinal hemorrhages might exist for some days and not be noticed by the patient. The application of atropine might also occasion the earlier outbreak; in two of my own cases glaucoma began immediately after its use (and examination with the ophthalmoscope), though this was at a later stage of the complaint. I may add that in almost two-thirds of the cases the glaucoma appeared between the fourth and the tenth week from the first functional disturbance. Thus the probability of its following retinal apoplexy diminishes, the longer the period after the tenth week.

Fortunately for the patient, the second eye remains perfectly free from disease in almost half the cases (10 out of 22, watched for at least two years). I saw, with Dr. Manhardt, a very exceptional case where great hyperæsthesia retinæ (constant vision of sparks, flashes, smoke, &c.) appeared in the second soon after the commencement of the disease in the first eye. As the glaucomatous eye was quite blind, and after iridectomy remained tense and extremely painful, it was enucleated. This had no effect on the hyperæsthesia. Since then more than four years have passed, during which there has been no organic disease or diminution of S whilst the hyperæsthesia has gradually diminished, though it has not entirely disappeared. In 5 out of 22 cases a similar affection of the retina has appeared in the second eye soon after (or some months after) that of the first one, without being followed by glaucoma, so that the course was that of a simple senile apoplexy of the retina. Lastly, there were 6 out of the 22 cases in which the second eye was attacked exactly in the same way as the first one, and lost through the same succession of glaucoma. The eyes were usually attacked at an interval of many months; in one case, however, both became affected almost simultaneously.

I have also once seen subacute glaucoma attack an eye which had suffered two years previously from retinal hemorrhage; the latter had been cured for more than a year, the blood having entirely disappeared and the retina being partially atrophied. Supposing this sequence not to be accidental, we must admit

that arterial sclerosis continues to act after the retinal disease is terminated.

This form of glaucoma leads us again to the view formerly held, that arterial sclerosis is the essential cause of glaucoma. The discovery of its immediate cause, the increase of tension, neither supported nor contradicted that view.—In these cases it is more probable that the glaucoma is due to the disease of the arteries than to the retinal process, for the reasons already assigned.*

Although we have here good reason for attributing the glaucoma directly to the vascular disease, we have no grounds whatever for generalising and assigning the same cause to other species of it. As the rule, we find neither retinal nor choroidal ecchymoses so long as the disease is left to run its course, and even if the retinal hemorrhages after iridectomy might be supposed to be in some degree dependent on arterial sclerosis, yet we have already shown that they are proportional to the violence of the attack. This would appear to show that the retinal change does not precede, but is induced by the process. The existence of arterial disease is not proved to exist in ordinary cases, either by the ophthalmoscope or by examination of the heart and arteries. Lastly, the totally different course and the inefficacy of treatment in this form prevent us from admitting a common cause for it and the other varieties of glaucoma.

I have to add to my account of the spontaneous course that most patients suffer from the head-symptoms usual in sclerosis of the cerebral arteries, and that they often die from apoplexy tolerably soon after the commencement of the disease, as indeed they also do after simple senile apoplexy of the retina.

I am sorry to say that the treatment is very unsatisfactory, according to my own experience. Until glaucoma occurs, we may hope that the hemorrhagic process will gradually exhaust itself, and we may endeavour to promote such a termination by careful prophylaxis, mild derivatives, mineral acids, &c. This treatment may have some effect in preventing glaucoma, yet I have unfortunately learnt from experience that it may also fail. The prognosis is unfavourable from the time glaucoma appears. I had in earlier years performed iridectomy four times without any success, and had determined to abandon the operation in these patients, when Coccius's case (l. c. page 8) gave me again courage. I have since twice operated with no better result, so that I am obliged to consider success exceptional. Iridectomy generally promotes retinal hemorrhage in glaucoma, and here the natural tendency of the disease augments this effect to a pernicious degree. I have seen after the operation fresh and considerable hemorrhage making its way ultimately into the vitreous, and in one case rapid loss of what vision remained; iridectomy, though accurately performed, had at the utmost only a temporary effect in respect to the tension and pain, so that in two cases the eye had to be ultimately enucleated. Thus, I cannot recommend iridectomy in these cases, with my present experience. Enucleation is preferable if the pains continue after the

* I have only once seen glaucoma after retinitis albuminurica, and this case was one of renal atrophy from arterial sclerosis rather than of nephritis, according to Prof. Traube.

sight has been lost: by relieving suffering and restoring sleep, such treatment has probably some effect in preventing the disease in the other eye and in diminishing the risk of cerebral hemorrhage. As, however, the eyes are invariably lost when iridectomy is not performed, the publication of a series of cases, treated with this means, is certainly very desirable.*

The name *hemorrhagic* or *apoplectic glaucoma*, as referring anatomically to a definite form of disease, can of course only apply to the one described. Although the glaucoma is due to the vascular disease, rather than to the hemorrhage, yet there is, at all events, a regular succession of hemorrhage and glaucoma. Internal bleeding, with increase of any existing tension, may indeed occur in staphylomatous and buphthalmic eyes or in cases of intra-ocular tumours. The increase of tension is often very temporary. There was also in most cases a previous state of glaucomatous tension, which was only increased by the hemorrhage. Increased tension leading to glaucoma, is scarcely ever seen in traumatic hæmophthalmus, unless there are other complications, such as displacement of the lens. I have only twice seen glaucoma after spontaneous hemorrhagic choroiditis (both times one eye alone was affected); once in a case of hemorrhagic small-pox, where the irido-choroiditis,† which not unfrequently accompanies variola, assumed the characters of an hemorrhagic-glaucomatous choroiditis. Another time in a general hemorrhagic disease, where after epistaxis, renal hemorrhage, hæmoptoeic infarctus of the lung, &c., there was hemorrhagic separation of the retina with inflammatory symptoms, and a little later acute glaucoma. Yet such cases would not suffice for the foundation of a hemorrhagic glaucoma, owing to their isolated character, and the co-operation of other causes besides the hemorrhage.

Optic Nerve.—Its diseases appear to never induce glaucomatous tension; at least, I have never seen any such effect in numerous cases of optic neuritis, the disease in which we should be inclined to most expect it. I have on a former occasion (A. f. O. viii, 2, p. 308–10) made some remarks on amaurosis complicated with glaucoma. The mutual relations of the two are still dubious; a common cause most likely educes successively the disease of the nerve and the increased tension; we cannot, at all events, attribute the production of the latter to the former.

Sclera.—It is extremely difficult to decide how far this membrane is engaged in the production of glaucoma. It can scarcely be doubted that rigidity of it is a very important *predisposing* cause,‡ for this reason we find glaucoma more frequent in hyper-

* Laqueur (l. c., p. 56) quotes two cases in which iridectomy had a satisfactory effect. We are, however, not quite certain that they really belonged to this category.

† Variola may be accompanied not only by genuine pustular ophthalmia and purulent infiltration of the centre of the cornea, running a peculiar, extremely rebellious, though not phagedenic course, but also by a sero-plastic iritis, always attended with serous choroiditis, at least the latter was always present in more than 30 cases that I have seen. Simple iritis perhaps never occurs, is at all events extremely rare. Posterior polar and cortical cataract may be caused by the accompanying disease of the vitreous, and will persist after the other symptoms have entirely disappeared.

‡ Stellwag von Carion (Der intraoculare Druck und die Innervationsver-

metropes and the old. On the other hand, we are still quite ignorant how far the sclera may form the direct, so to say, active origin of glaucoma. Many authors (Coccius, Cusco,)* have published facts and considerations with a view of showing that it has a very important influence in this respect also. The case reported by Coccius† in this Archiv. (vol. ix, 1, p. 19) is of very great interest in this respect. Yet the reliable data hitherto adduced in proof are very few. Admitting that differences in the resistance of the sclera have great influence over the production of the pressure-excavation, that it is perhaps owing to them that glaucoma occurs in the old under conditions which the young can bear without injury to the disc, and that the ciliary nerves from their intrascleral course (scleral passage) may readily become the source of abnormal irritation; yet all these points still require thorough examination, from which we may perhaps derive most important conclusions hereafter.

Intra-ocular Tumours.—We shall conclude our review of the different forms of secondary glaucoma with the mention of that caused by intra-ocular tumours. This variety has been already sufficiently discussed in various publications; the gliomata of children sometimes lead to gradual increase of tension or to glaucomatous attacks, though not until the neoplasm is of large size, so that the diagnosis is not obscured by the symptoms of glaucoma. Moreover, attacks of inflammatory glaucoma are much rarer than plastic irido-choroiditis with transitory phthisis bulbi when the tumour is breaking up. Glaucoma is excited far more often by sarcoma of the choroid or ciliary body in adults or the old; this may happen even at an early stage, and may then throw difficulty in the way of diagnosis.‡ Separation of the retina does not prevent glaucoma in these cases. Sometimes the tension continues tolerably normal until the glaucoma breaks out as

håltmisse der Iris, p. 41) seems to me to generalise this predisposition too far, when he says, "It is now settled, that glaucoma, strictly so-called, occurs only in eyes with a very rigid capsule." A glance at secondary glaucoma which may occur with all possible previous conditions of the sclera, especially at the form accompanying posterior ectasy, sufficiently shows the absence of this cause in very many cases. That the sclera is usually rigid after the persistence of glaucoma for a length of time, must be used with great caution in respect to the pathogenesis, for the nutritive changes accompanying increased pressure may indisputably exercise a (consecutive) influence on the structure of the sclera.

* Cusco bases glaucoma in general on a chronic inflammation of the sclera, with retraction of its tissue. To support this view, anatomical data would be indispensable, yet, though the author appears to possess some such, I do not find them anywhere adduced.

† Coccius found in two eyes, on which he had operated a year previously for glaucoma, extensive fatty degeneration of the sclera, most decided towards the equator. He considers this to be the effect of previous inflammation of the scleral connective tissue.

‡ See on the points guiding our diagnosis, A. f. O., xiv, 2, p. 116, and following.

a sudden inflammatory attack; generally, as the tumour enlarges, the tension increases, and when it exceeds a certain degree, there is a subacute or acute attack. Atropine, which we are so likely to use in such cases for the purpose of diagnosis, is very liable to excite a violent attack.* As the primary disease scarcely ever affects both eyes, the glaucoma follows the same rule. Iridectomy either fails entirely or has only a temporary effect, so that we are obliged to have recourse to enucleation.—I have also twice seen glaucoma after exophthalmus from orbital tumours: the immediate cause was, however, in both cases secondary disease of the inner membranes (choroido-retinitis, or with intra-ocular effusions).

Simple Glaucoma, its nature.—The doubt felt in former days whether the same process could excite both the inflammatory changes of typical glaucoma and simple increase of tension, has now been partially removed by our fuller knowledge of secondary glaucoma and by recent alterations in the theory of inflammation. When we see in secondary glaucoma, for example after displacement of the lens, one day simple increase of tension, and the next day inflammatory cloudiness of the media, alternating just as the cause acts more or less intensely, we may be certain of the essential identity of both forms and that they are due to modifications in the intensity and duration of the cause. If we admit the form with cloudiness of the media to be inflammatory, we cannot, I think, deny that the other, which is so closely allied, is also of the same nature, although, for the sake of distinction, it may very well be called the “non-inflammatory,” or “simply secretory” form. The supposition of a simple difference in degree is supported by Colnheim’s theory, according to which inflammation is essentially a species of abnormal secretion. If the cause acts rapidly and powerfully on the vessels, so that the cellular elements pass abundantly into the ocular media, the haziness becomes perceptible; whilst if the cause acts more slowly and less intensely, the cloudiness is not sufficient to be recognised. A very little addition will then render it visible, such as, for example, is produced by the congestion after meals.

The real difficulty in respect to glaucoma simplex arises from our *ignorance of any immediate or remote cause*. In secondary glaucoma we find, in one or the other tissue, a stimulus exciting hypersecretion, and as the former is usually permanent, so also is the effect. If temporary arising for example, from a swollen lens, the tension may also again diminish, though if the latter has attained a certain degree and duration, it will persist after removal of the cause; it is doubtful whether this is due to persistent irritation of the secretory nerves or to a continued

* Dr. H. Derby has also published a number of such cases, as we have already mentioned.

pernicious reaction by the anatomical results of the increased tension. We can understand how a typical inflammatory glaucoma may leave changes, such as contraction of the emergent veins or alterations of the ciliary nerves, so that, even without a recurrence of the inflammation, the pressure persists and leads to destruction. When there are recurrent attacks of inflammation, we feel more acutely our ignorance of their causes, though, as in other forms of recurrent inflammation, we may refer them to remote conditions and processes in the organism. But when, as in glaucoma simplex, the pressure augments very gradually for months or years (though depending anatomically on the same, but less intense, processes), always advancing and never diminishing, we naturally ask where is the continued stimulus that causes this course. Even if we admit an idiopathic affection of the nerves from some extra-ocular source, it would still be very surprising that the tension never diminishes again. *A priori* it is far more probable that the cause is *intra-ocular*.

Variations in its Course.—The results of treatment force us to admit a *latent intra-ocular* cause for glaucoma simplex and lead to the opinion that this cause is subject to fluctuations. Whilst the operation has a perfectly uniform effect in simple inflammatory glaucoma, whilst in secondary glaucoma its various results may be naturally deduced from the nature of the primary cause, we are obliged to admit that cases of glaucoma simplex vary extremely in their ultimate course, even when the pre-existing conditions appear to be exactly similar. The result is often very satisfactory in a relative sense, when the operation is performed at a late period; I mean that after six or seven years the patients continue to see decidedly better than at the time of the operation; in some, operated at an early period, the vision remains for many years in the same state, then gradually deteriorates; in some, again, the disease is not rendered perfectly stationary; and finally, some, fortunately very rare, patients become rapidly blind after the operation. When we accurately determine and record the tension, we find that these differences more immediately depend upon its variations. Thus iridectomy reduces the tension directly and permanently to its normal amount in most cases of simple glaucoma. It reduces it considerably, but does not render it quite normal in others; the vision usually continues in the same state, the eye acquiring, as it were, a sort of adaptation to a moderate increase of tension; yet not unfrequently the sight becomes again worse after a time, or the pressure again increases slightly and gradually, until in either event by a second operation, which I shall afterwards describe, it is rendered permanently normal and the vision secured. In a third series, the tension is normal or but little increased soon after the operation, whilst at a later period there are from time to time considerable increases, which do not always permanently yield to a second operation.

Lastly, iridectomy is sometimes followed by greater instead of less tension, the result being that vision is lost by progressive impairment or by a sudden attack resembling acute glaucoma.

Hence it would almost seem as if iridectomy had such an uncertain effect in simple glaucoma as to render its indication doubtful. This conclusion is found to be quite erroneous when we consider the numerical distribution of the varieties described. It has been already mentioned that in more than half the cases, a single operation renders the pressure permanently normal, and not only preserves, but even gradually improves, the vision for a long period. The second category includes fully one-fourth of the cases, and though our object cannot be said to be fully attained, yet the result is generally satisfactory: it may be necessary to repeat the operation in some few cases in order to secure permanent success. A second operation sometimes stops the progress of the blindness in the third category where the disease recurs; it at all events renders the deterioration slower in comparison with the spontaneous course. The last variety alone is thoroughly unfavourable, blindness being hastened by the operation. Yet this "malignant" course is extremely rare: I have seen it fully developed only five times in some hundred cases of simple glaucoma on which I have performed iridectomy. Judging not only by my own practice but also by that of others, it does not form two per cent. of the cases of glaucoma simplex submitted to operation. Now an operation that gives permanent protection from blindness in more than 90 per cent., renders the course slower in the majority of the remainder, and does harm in less than two per cent. is indisputably indicated, though exceptional bad results, such as never occur in an analogous manner in inflammatory glaucoma, may necessitate prudence in the prognosis.

The effect on the tension is reflected in a very instructive manner in the behaviour of the eye, even during the first few days, in part *immediately after the operation*. Whilst, as already mentioned, the tension in inflammatory glaucoma is rendered uniformly normal, with the exception that it may be moderately increased during the beginning of the healing process and that there sometimes remains a slight excess, quite compatible however with permanent success, the wound rapidly heals, and the anterior chamber is refilled immediately after the operation, or in a few hours, exceptionally not till some days afterwards, the state is quite different in simple glaucoma. If we make it our practice to examine each eye immediately after iridectomy by palpation, of course with the necessary delicacy, we shall find that the resistance varies much in glaucoma simplex. Some eyes are almost as soft as (even softer than) the average normal eye after it has been punctured, in others the tension remains greater than it ought to be in the normal eye

before it is punctured. We find every degree of abnormal tension between the two. Now the anterior chamber will not be rapidly reformed when the tension immediately after the operation is considerable; the chamber will not refill till the third, fourth day, or later, even when the tension does not reach quite such a height, though decidedly exceeding that of a punctured eye. If, on the other hand, the resistance is but little greater than that of a punctured eye, the chamber is permanently refilled (the incision being made with the lance-knife) immediately or very soon after the operation. The unfavourable results, noted above, occur when the chamber is slow in refilling. The pressure may even increase somewhat for a few days, during which time the iris and lens are pressed against the cornea, which consequently becomes somewhat hazy in most cases, the eye waters, the congestion is pericorneal and peculiar, due principally to enlargement of the anterior conjunctival veins which do not run in straight lines in their usual manner, but bend at obtuse angles; their anastomoses with the episcleral vessels, which are also much congested, are likewise very noticeable. Palpation, especially of the ciliary region near the wound, is painful, and the patient complains of more or less ciliary neurosis and loss of sleep; vision decreases in an alarming manner. The chief danger, when the anterior chamber does not refill, is caused by a *consecutive increase of tension (with symptoms of irritation)*, on which the other symptoms obviously depend. The danger is less when there is *no irritation*, that is, when pain on palpation (not spontaneous ciliary neurosis, which is caused directly by the increase of tension), lacrymation, and marked congestion (of which the character is determined ultimately by the state of the tension) are absent; the eye usually becomes softer in some days, and though the chamber does not refill till the second week or later,* yet afterwards the course is tolerably satisfactory in most cases. If there is no irritation and the tension is but little increased whilst the chamber keeps empty, we may expect that the aqueous will begin to appear again in a few days, that a little later the chamber will be quite normal, and that the result will be satisfactory.

Though a signally *malignant course* is observed in less than 2 per cent. of the cases of simple glaucoma treated by operation, yet in a much larger proportion, about 10—12 per cent., the chamber is slow in refilling (after the second day), owing to the tension being relatively too great. About one-half of these present symptoms of irritation, which are, however, generally slight, and fortunately disappear under proper treatment, as

* Very different are the cases in which the chamber remains empty for a long time owing to irregular healing of the wound (cystoid cicatrix). The tension may then be perfectly normal, the eye, indeed, is often abnormally soft; such a delay, when the tension is normal or diminished, does not involve the least danger, apart from the abnormal cicatrization.

the chamber refills and the tension decreases. Yet here we find almost all the cases in which the reduction of tension is incomplete or is followed by a fresh increase.

Returning to the "malignant course," we may add that it presents various forms. The irritation may steadily increase during the first few days after the operation, the tension may become so great that the eye, though the anterior chamber is empty, presents a stony hardness, and even the last trace of vision is lost. The cloudiness of the posterior surface of the cornea and a diffuse haziness of the vitreous, which certainly exists, prevent any accurate examination of the fundus. No vision ever returns, though some weeks later the pressure decreases and a shallow chamber reappears. We then find a tolerably diffuse, delicate opacity of the vitreous or retinal separation: I have seen the latter follow in two cases, whilst the tension was decreasing; once indeed the vitreous had been punctured. Sometimes the anterior chamber is permanently obliterated owing to adhesion of the iris and cornea, though the tension ultimately decreases. In other cases the symptoms of irritation may not be so great, or they may remit to a certain extent, yet the chamber continues empty, the tension persists, there is more or less abnormal irritability, and the vision is gradually lost, just as in progressive glaucoma, the field contracting, &c. There can be no doubt that the operation excites a fresh and more acute glaucomatous process, which does not present its ordinary symptoms simply owing to the complete absence of the aqueous humour. Judging by the painfulness of the ciliary region near the wound, this process would appear to spring from irritation of the ciliary body; a further ominous feature is the sympathy of the other eye, even after it has been already operated with success.* I have

* Remark. I shall never forget the case of the Dutch apothecary, G., on whose left eye I first operated for advanced glaucoma simplex with contraction of the field of vision. The chamber did not refill till the seventh day, whilst the tension, which had been at first very ominously increased, had gradually lessened on the fourth and fifth days; there were no marked symptoms of irritation. The case belonged to the second of the categories described above, in respect to the tension. It continued a little too great, yet the vision, which had distinctly deteriorated before the operation, now became stationary. Six months later, the patient returned for the operation on his right eye, which now presented just the same symptoms as the left had done. The operation was perfectly regular; after it the tension was very considerable, the chamber continued empty; on the second day there were symptoms of irritation of the kind already mentioned, which were followed by increase both of them and of the tension, with rapid impairment of his sight; next week, sympathy of the left eye, in which there now appeared an ominous congestion, with dilated anterior conjunctival and episcleral vessels; on both sides progressive blindness (with the symptoms of glaucoma modified by the absence of an anterior chamber). The patient was too much discouraged to submit to any attempt to arrest this process by further treatment. There had been clearly some such tendency in the left eye, as the chamber did not reform till the seventh day.

failed to find any reason for this course, either in the manner of performing the operation, or in the personal peculiarities of the patient.

I wish to call attention to the fact that I have seen this course exclusively in *glaucoma simplex* strictly so called (apart from a glaucoma secondary to displacement of the lens, also without haziness of the media), *i.e.*, only where no periodical obscurations of the media could be found by careful and repeated examination. I may say the same of the analogous cases in which the chamber is late in refilling, where the tension remains increased for a long time after the operation, and where there are symptoms of slight irritation. I have never seen such a course in cases of inflammatory or subacute glaucoma with periodical cloudiness of the aqueous humour. I must also add, that all the eyes in question were *very tense* before the operation. There appeared to be in some a peculiar cloudiness of the subconjunctival connective tissue, so that the swollen muscular or anterior ciliary vessels presented a peculiarly dull hue; this point, however, requires further attention.

Hence there must be a difference—and here we return to the subject with which we commenced our remarks—between apparently similar cases of simple glaucoma, owing to which the very same operation may diminish the tension immediately and sufficiently, imperfectly or not quite permanently, or on the other hand may excite a sudden and pernicious increase. We have already learnt that there are cases of secondary glaucoma clearly arising from an intra-ocular cause, in which the latter can be determined only by the antecedents. Such is the form that occurs with posterior cortical cataract after serous choroiditis, at a time when its principal effect, diffuse obscuration of the vitreous, has passed away; such also is the one following retinal hemorrhage at a time when every trace of the latter has disappeared. Just as in these cases the cause of glaucoma is latent when the operation is performed, so there may be causes of simple glaucoma, which escape our notice; a great part indeed of the structural and circulatory changes, which affect the eye, are not directly accessible to our present means of examination. We have already spoken many times about choroiditis latens, *i.e.*, about choroidal changes which cannot be shown objectively at every stage, but which are demonstrated by the course of the disease. It is in this way alone that we can account for the peculiar reactions after operations on certain forms of cataract. It is quite certain that there are diseases of the vitreous without any ophthalmoscopic symptoms whatever; thus when the lens is very mobile, passing sometimes into the vitreous, sometimes into the anterior chamber, we cannot doubt that the vitreous is unnaturally fluid, and yet we are assisted to this conclusion only by accident.

Important parts, such as a portion of the ciliary organs and the sclera, which are very likely to participate in the genesis of glaucoma, cannot be directly examined. The absence of inflammation in simple glaucoma harmonises with the view that it arises from a tissue with very sluggish nutritive changes and a peculiar vascular torpidity. The differences in the course of the disease

and in the results of treatment, may readily be imagined to be due to the implication of particular parts of the sclera, a membrane largely connected with adjacent tissues, and through which various vessels and nerves pass. As in other disturbances of innervation we attend especially to those portions of the nerve passing through bone or tendon (numerous cases of neuralgia and paralysis are now-a-days referred to periosteal irritation at those spots, &c.), so in respect to the ciliary nerves their passage through the sclera seems to me to deserve a thorough examination. I should suspect senile rigidity or pathological contraction of the sclera, because of the interference with nerves containing secretory fibres, and not because it directly compresses the contents of the eyeball, nor yet because the venous circulation is impeded or obstructed (see Stellwag, l.c., p. 43).

It is a doubtful proceeding, when we are without positive data, to employ hypotheses. Yet, apart from the fact that they are likely to give the necessary impulse to investigation, it seems desirable to us to form such views of simple glaucoma as will not contradict current pathological doctrines and analyses in respect to other forms of the same disease. For these reasons we must suppose, in my opinion, that there is a permanent stimulus in the eye; we are also obliged, owing to the entire similarity of the course and effects of treatment, to consider the disease a *secondary glaucoma* with a varying or at least not uniformly localised *intra-ocular cause*. The cause itself is still doubtful, yet for various reasons special attention should be directed to the sclera in future clinical and anatomical researches.

Glaucoma simplex affects, almost without exception, both eyes successively, indicating that the cause also is symmetrical. Iridectomy is the principal means of treatment. Paracentesis has no permanent effect, though it possibly may be of use in regard to the prognosis. If it reduces the tension nearly to that usually found in a punctured eye, we may be certain that iridectomy will have a permanent effect, and that there is no tendency to a malignant course, or even to an insufficient result of the operation. If again the hardness continues relatively great, the anterior chamber will be slow in refilling and the course will be threatening, though malignant only in a minority of patients. Possibly a methodical repetition of the puncture would reduce the tension, and thus, as the puncture itself has no permanent effect, prepare the way for iridectomy. I cannot, however, yet say whether such a proceeding will succeed, or whether in cases where iridectomy is followed by a malignant course, paracentesis itself would be attended with the same risk. As to the iridectomy, I need scarcely repeat that, in order to reduce the tension with the greatest possible certainty, the usual rules about size and peripheral position (and the avoidance of adhesions, to which we shall return at the end of this essay) must be strictly observed in

cases of simple glaucoma. The disease differs in this respect from inflammatory glaucoma, where carelessness in the operation is often enough followed by no injurious effect. The after-treatment, which presented no peculiarity in the inflammatory form, here requires much consideration. The tension of the eye should be carefully examined immediately after the operation, or if chloroform is used, as soon as its effects have disappeared. When the tension scarcely exceeds the average resistance of a punctured eye, we may expect that the anterior chamber will be soon refilled, and even should this not occur for some days, that the course will be satisfactory with the usual treatment. The continued use of the charpie-bandage is advisable for the prevention of cystoid cicatrisation; atropine may also be applied from the second day with advantage. On the other hand, if the tension exceeds considerably that degree, the eye must be simply closed with plaster. I am firmly convinced that a *bandage applied to a relatively tense eye, decidedly increases the after-danger*.* The slightest pain should be opposed by a subcutaneous injection of morphia in the temple. If next morning the pressure is not decreasing—the chamber will, of course, still continue empty—occasional tepid fomentations with chamomile infusion, a purging powder of calomel, and in plethoric people venesection, are advisable. The fomentations, powder, and subcutaneous injection should be repeated during the following days according to circumstances. If the pressure is once decidedly diminished, we may calculate on the chamber being soon reformed, and on the course being tolerably satisfactory, unless the vision has already exceptionally decreased. I do not recommend atropine in these cases during the first few days, because, with the existing tendency (as in chronic glaucoma) it may excite an acute increase of tension. These means during the first few days not only counteract the tendency to a malignant course, but conduce to the completeness and permanency of the reduction of tension, on which the future fate of the eye depends. As already mentioned, the very eyes in which the pressure is insufficiently reduced soon after the operation, are usually the most prone to ulterior deterioration or recurrence.

Supplementary Iridectomy.—If, notwithstanding all this care, the vision becomes again worse after it has been stationary for many months, and the tension increases or recurs, the first means, provided the latter is not very great, should be occasional local blood-letting by the artificial leech. I have already on a former occasion recommended this treatment to be pursued some months after the operation, and can now repeat, what I then said, in respect to many cases of simple glaucoma (and of secondary

* Remark. Moreover, if it is applied after irritation has commenced, to a tense eye with an empty anterior chamber, it may excite most alarming symptoms.

glaucoma from sclerotico-choroiditis posterior). The favourable effect of this treatment is again a reason for believing that this affection is due to some intra-ocular irritation. Should this means fail, it might be a question whether we should have recourse to paracentesis, methodically repeated; my own trials, perhaps not sufficiently carried out, have not given any decided results, and for some years I have abandoned them, because I found that excision of a diametrically opposite piece of iris very decidedly reduced the tension of the eye. I shall treat this subject, already repeatedly mentioned in this paper, specially here, because it is most frequently indicated in simple glaucoma. Many comparative trials in the years 1865-67 proved that excision of the opposite piece of iris had a far more decided effect on the tension than that of the adjacent (even extremely large) portion of iris. These trials were made a few times when both eyes were in almost exactly the same state; the result was decisive, for excision of the adjacent piece had afterwards to be supplemented by that of the opposite portion of iris. I must indeed confess that I have become dubious whether excision of the adjacent piece has any influence over the tension; it is at all events very slight, and will generally not suffice in cases where the first iridectomy has had no sufficient or permanent effect. On the contrary, I could adduce at least a dozen cases, where excision of the opposite piece has had a permanent effect after failure of the first iridectomy. The following case, seen by me and also by Donders, may serve as an example:—

Mrs. H., thirty and some years old, rather delicate and anæmic, had both eyes operated upon by Donders in September, 1866, on account of simple glaucoma. As there was then only some quantitative perception in an excentrical portion of the visual field of the left eye, the operation was performed, rather to prevent future trouble than on account of the sight. On the right side the condition was, according to Donders' note, tolerable, $S = \text{about } \frac{1}{3}$, and the field of vision having only lost about its lower third. In December, 1866, the patient changed her residence, and was recommended to come under my care by Donders, who stated that the tension, notwithstanding a perfectly normal course after the operation, had never decreased quite to the physiological limit, and that the vision also had become gradually worse. I found in each eye a perfectly regular broad coloboma at the upper part and reaching quite to the periphery, an almost typical excavation, extremely steep towards the temporal side, with marked distension of the veins beyond the edge, the tension a little greater than the physiological extreme; on the left side the vision was almost lost; on the right side $S \frac{1}{5}$; almost the whole lower half of the field of vision was wanting: a line limiting it passes just below the point of fixation, extends horizontally to the inner, and slightly downwards to the outer side, so that a small portion of

the outer and under quadrant remains. Further observation showed, that there were from time to time neuralgic pains in the forehead and temples, during which the tension slightly increased. A few times I discovered also very slight cloudiness of the aqueous during these pains, which, by-the-way, had never the characters of genuine paroxysms. The artificial leech was applied occasionally, the patient was kept in a state of perfect rest, all injurious agents were avoided and mild laxatives administered; the vision became no worse from December, 1866, to February, 1867, although the tension did not decrease. This stationary condition proved to be only temporary. She was then watched alternately by Donders and by myself; soon after the treatment described, and notwithstanding the use of various other means (whey-cure, subcutaneous injections of morphia, &c.), the vision was found to be gradually becoming worse.

When she returned to Berlin in November, 1867, S had sunk to $\frac{1}{16}$. The change in the field of vision was relatively less; the line limiting it now passed through the point of fixation, extending inwards somewhat above, and outwards coinciding with, the horizontal line drawn through the same point. The excavation and the tension were unaltered. In the following three weeks, during which mild derivatives were used, the vision became seriously worse, so that at the beginning of December, 1867, S = only $\frac{1}{24}$, and she began, when looking at even small objects, to use an excentric part of the retina. Convinced that the progressive deterioration was due, neither to any complication, nor to an independent advance of the secondary atrophy of the optic nerve, but simply to the continuance of a *relatively* (and also in some degree absolutely) too great tension, I excised, on the 4th December, 1867, a second piece of iris at the lower part. The tension was immediately after the operation similar to that of a punctured eye, and the chamber refilled at once. Even during the first period of healing the tension was in every respect very favourable; it was not only below the physiological maximum, but scarcely reached the normal average, where it remained constant. It was now very instructive to compare the left eye, both as to the tension which gave an excellent index of that previously existing in the right eye, and as to the excavation. The latter had been nearly the same on both sides; it now strikingly diminished in the right eye, where its nasal edge almost entirely disappeared; its temporal side (previously extremely steep, as it still is in the other eyeball) became gently inclined, and the marked difference in the size of the veins within and beyond the excavation, was almost completely lost. The vision was still more satisfactory: instead of a gradual impairment, it slowly but steadily improved. In February, 1868, eight weeks after the second operation, S was again $\frac{1}{20}$, the field of vision slightly larger; six months after the operation, S $\frac{1}{16}$, field of vision still

larger; a year and a half after the operation $S \frac{1}{12}$, the line limiting the field of vision passes a little below the point of fixation, extends horizontally inwards, but reaches to the outer side as far down as to include within the percipient region fully the upper third of the outer and under quadrant. The tension is perfectly uniform; it certainly does not exceed the physiological average, and of course is widely different from that of the left eye. The periodical pains no longer return.

With such experience, I am more particular than ever in insisting on a *sufficient reduction of tension after the operation for glaucoma*. If after the operation the tension exceeds the physiological average—in which case there may well be a relative increase—or the physiological maximum, and the vision shows the least tendency to become worse, I should have no hesitation in advising a second operation. Of course, the earlier it is performed the better will be the result. The second must be performed exactly in the same way as the first operation.

Let us now return after this survey of the various forms of glaucoma, which unfortunately exposes at the same time our ignorance of many and important points, to certain details, which could not be previously treated without interrupting the continuity of our narrative.

Traumatic Glaucoma.—The question has been raised in respect to the causation, how far this affection can be attributed to a traumatic source. The answer will be decidedly affirmative, if we include not only its direct production by a traumatism, but also its indirect development in the form of a secondary glaucoma. For example, when the capsule of the lens is ruptured by an injury, the swelling may be followed by glaucoma. If the injury ruptures the zonula, and thus cause mobility or real dislocation of the lens, glaucoma is produced, just as after a spontaneous displacement.* If, moreover, there is a penetrating wound of the cornea with strangulation or prolapse of the iris, the case presents conditions which are extremely active in promoting glaucoma, as we have already learnt. Foreign bodies, passing into the eye, may excite iritis and adhesions, and be then followed by the same disease. It is a very rare, though not quite impossible, occurrence for the hemorrhagic and hemorrhagic-inflammatory states which follow a *single* violent blow and which are usually accompanied by separation in the continuity of one or the other membrane, to cause glaucomatous tension, unless there is some permanent irritant (foreign body, rupture of the capsule, dislocation of the lens, strangulation of the iris, traction by a cicatrix). Traumatic

* The glaucoma may be erroneously supposed to be primary, owing to the true cause being overlooked when the tremulousness is only slight.

inflammations far more frequently assume a hyperplastic character, and either do not influence the tension at all or only in a negative sense. Very different is it in respect to its direct causation by the traumatic irritation, and not by any other intermediate state in the eye,—when it is developed after a simple contusion through an affection of the secretory nerves, &c. Such a course is extremely rare, if indeed it ever occurs. Increased secretion seems to occur principally when an irritant *continues to act* for some time, whilst a sudden violent traumatism is far more likely to produce a species of secretory paralysis with negative tension of the eye. The trauma acts in the way first mentioned by the intervention of some of the secondary causes previously mentioned.

I have indeed occasionally met with perfectly typical glaucoma, which was attributed by the patient to some traumatic cause. Thus one case was asserted to be due to a cannon-ball striking near the patient during the last war, another to fragments of a bullet flying past near the eye, another to lightning striking close to the patient, &c. We must be very cautious in admitting the correctness of such opinions, for, as such influences as mental excitement, loss of sleep, &c., usually present in these cases, are by themselves not unfrequently followed at once by glaucoma, we may well doubt the predominance of the injury and suppose that the latter has simply acted on a predisposed patient in the way of an exciting cause. It is scarcely possible for an injury to directly cause glaucoma in a perfectly healthy eye; the close causal relation which exists in traumatic paralysis and neuralgia cannot be admitted in glaucoma, a result which may perhaps influence in some degree our conception of this disease.

Glaucoma after Operations.—We may here add a few remarks on this subject. Some of the intermediate links, which, as we know, are the immediate causes of secondary glaucoma, may almost invariably be discovered in these cases. The most decisive, and at the same time most common, examples of this are furnished by discision and reclination of the lens. Next we should quote anterior and posterior synechiæ. We have always been opposed to methods of operating (encleisis, iridodesis, &c.), the object of which is to produce anterior adhesions. I also think it very important to oppose any accidental inclusion of the edge of a coloboma in the wound, especially where there is any increase of tension. I believe—and shall return to this point—that the avoidance of anterior and posterior adhesions is of fundamental importance in the operation for glaucoma. There is relatively little risk from a few posterior synechiæ when the coloboma is large, though they may keep up an increase of tension when such a tendency is present. When the operation is performed at a late stage of chronic iritis, in cases of circular synechia, retro-iritic proliferation, when the periphery of the iris is applied to the

cornea, and when at the same time the peripheral portion is not excised or the proliferations on the posterior surface of the iris are irritated, fresh adhesions may be occasioned through the operation and increase the tendency to secondary glaucoma. The peripheral incision for the extraction of cataract also requires care in this respect, so that adhesions of the iris in the wound, which were formerly so common, may be reduced to a minimum and to the less dangerous forms (adhesion of the periphery alone, the sphincter being completely returned). The glaucoma, which used to be occasionally seen after flap-extraction, arose from remnants of cortex, from prolapse of the iris, from chronic iritis, and iridophakitis with adhesions. I only remember once seeing acute glaucoma immediately (next day) after a normal flap-extraction; this was possibly accidental, or perhaps the operation acted simply as an exciting cause in promoting an early outbreak.

Glaucoma after the Discision of Secondary Cataracts is relatively common: any fresh operation may excite secretory irritation after reclination of the lens, through slightly changing its position. Glaucoma is, however, by no means rare after extraction or discision; Bowman (*Ophth. Hosp. Reports*, iv, 4, p. 365) has called attention to this point. I think this succession may be attributed to two causes: secondary cataracts contain not unfrequently within the collapsed capsule remnants of cortex, which, after a fresh operation, are liable to swell and irritate the posterior surface of the iris and ciliary organs, especially if the pupil is small. Unless great care is taken, there may also be some displacement of the capsule, with traction and irritation of adherent ciliary processes, especially when the capsule is tough, not diaphanous, but forming an opaque membrane or presenting opaque stripes. These causes may account for glaucomatous tension, usually with a little cloudiness of the aqueous, appearing immediately or gradually. I think that any such complication may be avoided by proper care. In the first place, the capsule should never be divided, not even punctured, when the pupil is small and resists mydriatics.* Hence Bowman saw this form of glaucoma far more often in cases of secondary cataract after flap-extraction than when the original operation had been combined with iridectomy.

When an operation for capsular cataract is indicated under such conditions, the pupil should be sufficiently enlarged by an iridectomy at the upper part. If, as sometimes happens, one iridectomy does not suffice, there should be no hesitation in ex-

* Remark. This is still more important in discision of the lens itself. Especially in congenital cataract is it bad practice to open the capsule without a preliminary iridectomy, when the pupil is small and dilates with difficulty. In many of Bowman's cases, iritis with circular synechia intervened, there being noted not only "a general projection of the iris," but "partial bulgings," which are found in circular synechia alone.

cising the diametrically opposite piece before the capsule is touched. Should there be any reason to suspect the existence of cortical remnants, our next step will be to make a perfectly simple and not too extensive linear incision in the capsule; a fresh operation, that usually required is a freer discision, should not be performed until the fragments of the lens have been absorbed. The best direction for the incision in the capsule is along one diameter; this usually suffices for optical purposes in the translucent forms; if, when the needle is withdrawn into the anterior chamber, the wound does not sufficiently gape, it must be enlarged, care being taken not to approach the edge of the pupil and not to cause any traction of the ciliary organs. No special rules can be given, the resistance of the different parts of the capsule deciding the direction.

It is very important to attack the very translucent and yielding parts alone. To tear by force or to partially displace tough opaque capsule, whether by one or two needles, is attended with danger; I would not recommend at all events those who possess some vision to submit to treatment which may not improbably cause deterioration, even loss of the eye. It is much better, when there are striped (consecutive tissue) membranes, to perform a peripheral iridectomy in the direction in which they become diaphanous, and then to simply divide this transparent portion. By following these principles,*—and these lengthy details may be excused owing to the importance of the subject,—I have avoided for many years glaucoma (and any unwelcome reaction) after operations for capsular cataract.

The most enigmatical effect of any operation in regard to glaucomatous tension is the malignant course of a few cases of glaucoma simplex after iridectomy. The very operation, which usually acts beneficially on excessive tension, seems here to have exactly the opposite effect. The cause of this must necessarily be in the most immediate effects of the surgical act. Possibly the wound has some special relation to the point from which the disease springs. We can easily imagine that the ordinary traumatic irritation may have a different effect when the disease arises from the most anterior part of the sclera or from the ciliary organs. Or, is the cause the escape of the aqueous, causing an

* I am quite willing to admit that a more perfect result (optically, and still more cosmetically) may now and then be gained by greater boldness, by forcible laceration, displacement, or extraction of tough membranes, than in the manner described. Yet I think that such a possibility, when compared with that of causing blindness, will not charm a conscientious operator. In the zonular cataract of adults, we prefer iridectomy, owing to the danger of a cataract operation. Only in very exceptional cases, where, for example, the other eye is perfectly serviceable, and the cosmetic effect seems indispensable, can a more dangerous method be admitted after the risk has been fully explained; according to my experience, extraction by the peripheral linear incision is decidedly the least dangerous.

advance of the lens, tension of the zonula and ciliary organs? After all we must admit a peculiar secretory irritability, which again leads us to the supposition that there is some pre-existent peculiarity in the case.

In operations, much as in injuries, the glaucoma is secondary, and the operation has a direct causal connection with certain intermediate states rather than with the glaucoma itself.

Hereditary Glaucoma.—The older authors fully recognised the importance of inheritance. This influence seems to predominate in typical inflammatory glaucoma,* which often attacks several members of one family and is transmitted from generation to generation. I have noticed that the disease commences in the middle period, or even in the first half of life, after many generations have been already affected. There are some such families in Berlin, in which glaucomatous diseases have already affected three or four generations (possibly more); the first symptoms now usually appear at the age of 30 to 40, whilst the parents and grandparents became diseased at 50 or 60. In some such patients there is an unusually long premonitory stage, which begins at the age of 30 or 40, and continues for 8, 10, even 16 years. I once saw, what is certainly a rarity, glaucoma occur in both mother and daughter in the same year, notwithstanding a difference in age of 26 years. The special form often reappears with all its peculiarities in cases where the disease is secondary. I have already mentioned that glaucoma, presenting a wonderfully congruent course, may follow hereditary sclerectasia posterior; I have noticed a similar combination in cases of dislocation of the lens, and of cornea globosa. On the other hand, the primary state, unfollowed by glaucoma, may also reappear; thus I have seen secondary glaucoma attack only a single member of a family, although in all the brothers and sisters there was congenital displacement of the lens. This is the more intelligible, because in the same individual one eye alone sometimes suffers from the secondary disease. It would be very interesting in respect to glaucoma simplex, to note carefully those forms which show their relationship to it by hereditary co-existence. The simple has appeared to me far less frequently hereditary than the inflammatory form, but my data are too scanty for any decision.

Remarks on the Causation.—The old obscurity still generally conceals the causation of glaucoma, notwithstanding the researches of many recent observers. The occurrence of primary glaucoma only exceptionally at an earlier time than the second half of life, justifies us in some degree in associating its causes with the changes found at that period. But in what does the essential cause consist? In the senile changes of the tissues of the eye (sclera, hyaloidea, &c.), in sclerosis of the arteries, alterations of

* Very possibly the hereditary nature consists here in certain predisposing conditions, such as rigidity of the sclera.

the secretory nerves. All may be supported by particular reasons, but no one is proved by decisive facts. Moreover, secondary glaucoma shows that the process may occur at any age, provided the cause is sufficiently active, but the younger the patient so much the more active or persistent must be the latter. In a word, the (internal?) cause of primary glaucoma is scarcely found to exist, except with the decided tendency caused by advanced age. The predisposition, as is shown again by secondary glaucoma, depends on two circumstances: first, that in the old a given tension causes excavation more rapidly; and, secondly, that the former is itself developed more easily. The greater rapidity with which an excavation is formed is, of course, due to the resistance of the disc decreasing with age, most likely absolutely, certainly relatively to the sclera; further researches on this point are desirable. The more ready increase of tension is very possibly due to the secretory fibres contained in the ciliary nerves being more susceptible to irritation when transmitted through a senile rigid sclera, than when the latter yields as in youth. The same hypothesis would explain the far more frequent occurrence of glaucoma in hyperopic* than in myopic eyes, the sclera, particularly where the ciliary nerves pass through it, being undoubtedly more rigid in the former.

The course of future investigations is indicated to some degree, in that we must expect further light from accurate examinations of the sclera and disc, taking into special account the proportional resistances, and from anatomical and chemical investigations of the ciliary nerves,† comparatively in their extra- and intra-scleral course. It is to be hoped that such investigations will soon be

* I think Laqueur (l. c., p. 44) wrong to doubt this. The hyperopia is no doubt caused by the glaucoma in some cases, yet in others it certainly pre-exists; by comparing the relative frequency, we find that high degrees of hyperopia occur in a given series of cases of glaucoma far more often than on an average in other persons. I can confirm the statement that in cases of glaucoma treated by operation, the hyperopia not unfrequently diminishes, or, if slight, entirely disappears after a time. This may very possibly be always due to the following changes in the lens; the margin of the nucleus is found to reflect very strongly when examined by oblique illumination, whilst the lens is beautifully transparent when the light falls perpendicularly; its focal length is shortened, probably owing to there being a greater difference between the index of refraction of the nucleus and that of the cortex. Such a change is very common in glaucoma and may foretoken the formation of cataract, though by no means necessarily so; it is also found in other cases, in which likewise it may prove to be the first stage of a cataract. This cause of acquired increase of refraction has been hitherto little noticed. It may explain why a slight amount of myopia is really developed in very many cases of commencing cataract; the myopia, again, is in part the cause of misty vision of distant objects, and may also be corrected to some extent by negative glasses for a time.

† Magni's researches (Ann. d'Ocul., xlix, p. 160) cannot, in my opinion, be employed to explain the pathogenesis of glaucoma, as they simply prove *consecutive* atrophy of the ciliary nerves.

published, and that at the same time clinical experience may fortunately lead us to the remote (probably extra-ocular) cause of primary glaucoma.

Connection of the Excavation with the Functional Symptoms.—Since it has been known that in glaucoma the impairment of sight is generally accompanied by a change in the level of the disc, it has been admitted that the interruption of nervous conduction at the edge of the excavation is the solitary cause of the functional disturbance. This principle, though generally correct, requires some modification in particular cases. The increased tension has a complex action on the vision, and occasionally other conditions may exert a greater influence than the excavation. We have already mentioned that in acute glaucoma the vision is impaired *before* there is any distinct excavation; this impairment seems to me to be due to retinal paralysis from ischæmia and probably from imperfect nutrition, (softening?) of the retina. We find, however, in scattered cases of subacute glaucoma also, where occasionally the aqueous becomes uniformly clouded, whilst the eye remains abnormally hard during the intervals (intermittent glaucomatous irido-choroiditis serosa), that the excavation is small relatively to the state of vision, so that we may reasonably ask—are the fibres of the optic nerve bent at the edge of the disc so abruptly as to account for such great (in many directions, indeed, of the field of vision complete interruption) interference with the nervous conduction, or does not the tension modify at the same time the circulation and nutrition of the inner membranes, the latter changes specially originating the functional impairment, and the excavation being only an accompaniment of perhaps subordinate importance. We feel the same doubt in regard to certain cases of secondary and simple glaucoma. For example, I have seen, after reclination and in cornea globosa, great tension followed by gradual blindness, accompanied indeed by excavation, but one bearing no proportion to the functional impairment. I remember, likewise, some very old people in whom the tension was much increased (decidedly glaucomatous), the depth of the anterior chamber and the mobility of the pupil were distinctly diminished, and the vision was destroyed by a periodical loss of sharply bounded portions of the field of vision, and yet the only changes about the disc were a shallow depression and enlargement of the retinal veins. Besides, it is difficult to refer *sharply bounded* peripheral defects with perfect integrity of the adjacent regions and of the central vision, and such are really observed, to an interruption in the nerve-fibres at the edge of the disc. We can understand that fibres passing to the periphery suffer sooner, partly owing to their unfavourable position at the side and edge of the excavation, partly owing to a less power of resistance, than

those ending in more central parts of the retina, but we cannot understand why from a perfectly definite line in the field of vision there should be no conduction, whilst close to the other side of the same line it is normal. Such a state is, of course, exceptional in glaucoma, *Sc* generally diminishing in a gradual manner towards the defect; this condition is sometimes accompanied by other circumstances, which also induce us to doubt the importance of the excavation.

I will here mention a case which is instructive also in other respects. The patient belonged to one of the families affected with hereditary posterior sclerectasia and secondary glaucoma. When he came to me in 1857, the tension was very great, but the excavation of only moderate degree; I was surprised to find notwithstanding, a large, extremely sharply defined defect of the periphery of the field of vision at the nasal side, whilst *Sc* close to it was normal, and *S* rather greater than 1/1. Even at that time I doubted whether such a defect could be caused by the excavation, and therefore examined most carefully the whole of the fundus, but with a negative result. Iridectomy was performed: the patient is still under observation. Within a year from the time of the operation the outer half of the fundus, exactly corresponding to the contraction of the field, presented a delicately stippled decoloration of the choroidal epithelium, at the same time abnormal pigmentations in the same layer and in the retina itself; these changes increased for a number of years to such a degree that the ophthalmoscopic appearances would have certainly made one think of progressive choroido-retinitis. Yet the field of vision* and the central acuteness of sight remained for eight years exactly in the same state as before the operation. Hence I consider that the affection of the inner membranes must have existed before the operation, though then latent, and that it only became manifest by the ultimate occurrence of pigmentary changes.† It must also be supposed that the defect was not due to the excavation, but to the circumscribed choroido-retinitis, its amount and the normal state of the adjacent *Sc* and of *Sc* being far more characteristic of that affection than of a moderate excavation. The affection of the internal membranes could not possibly be considered an effect of the interruption of the nerve-fibres, for the latter would affect only the inner retinal layers, whilst here the disease commenced either in the outer retinal or in the inner choroidal layers. Returning to the question previously asked, does the choroiditis latens excite the increased

* Last year, for the first time, the contraction of the field increased, without any change in the central vision; I considered this due to an increase (congestive) of the choroido-retinal process, which was now independent of the original cause (increased tension); proper antiphlogistic treatment proved of use.

† Hence the case is also interesting in respect to the existence of choroiditis latens.

tension, after the manner of a secondary glaucoma, or is it a consequence of the tension? The latter might, *à priori*, be supposed likely to excite such changes, owing to its influence on the arterial circulation, the return of venous blood, and the excretion of nutritive fluids. I myself incline towards the latter view, though unable to give a decided answer, for eight years passed without the least change, after the tension had been reduced to its normal limit. Such could scarcely have been the state if choroido-retinitis had been the primary disease, all the more because the patient used the operated eye alone in his business. This view is supported by the cases mentioned, in which for some time the tension alone was increased; then a sharply-bounded defect, which could hardly be referred to an interruption in the nervous conduction, appeared, and finally an excavation, which sometimes remained of small size.

Peculiar Disease of the Choroid and Retina.—I will here append an account of a case of the same kind, which was anatomically examined by Dr. Leber; it is the only one of which I possess such details.

Andreas K., a journeyman joiner, æt. 52, was admitted on the 14th Feb. 1867, into the eye-department of the Charité. His left eye, now phthisical and free from pain, had been lost three years previously. He says that since that time the vision of his right eye has been weak; the impairment was formerly gradual, during the last four weeks, after an ophthalmia from cold, more rapid. He drinks heavily; the central vision is moderately impaired,—the exact notes unfortunately cannot be found,—so that he can still read ordinary print; peripheral vision at the inner side is very indistinct. The most prominent symptom is torpor retinæ, especially of the part corresponding to the nasal half of the field, so that by lamp-light the peripheral indistinctness changes into a considerable defect, accompanied by a slight general concentric contraction. The outer parts of the eye present no change except that there is a tendency to pericorneal congestion, especially soon after waking. The pupil is usually of medium size, very sluggish, and dilates imperfectly after the use of mydriatics. The anterior chamber is somewhat shallow, the tension *much and constantly increased*. Hence I quite expected to find excavation of the disc; not only, however, were the disc and vessels normal, but no disease could be found in the fundus (excepting moderate congestion of the retinal veins). A fortnight later he died from delirium tremens.

The following is Dr. Leber's interesting report:—"Form and size of the eye are normal. Venæ vorticosæ are full of blood, not contracted. The eye was removed about 12 hours after death from the body, placed for some days in Müller's fluid, and five days later opened at the equator. Lens and vitreous still tolerably transparent; no disease can be perceived in the anterior half with

the unassisted eye. Moderate post-mortem cloudiness of the retina; the latter presents circular folds around the disc and macula, and others running towards the macula. Large irregular whitish spots in the outer under quadrant of the eye now shine through the clouded retina, especially in the region of the equator; of these no accurate judgment can at present be formed. The tolerably dark epithelial pigment can be wiped off with unusual ease, the subjacent stroma of the choroid presents no macroscopic change. Owing to the ease with which the choroidal epithelium separated at the edge of the section, we did not separate the retina from the choroid, but replaced the eye for a time in Müller's fluid, deferring a complete examination till it had become more thoroughly hard.

It now appeared, that most of the retina readily separated from the choroid as usually, that these membranes, however, adhered somewhat more intimately in the outer half, especially below and at a little distance from the disc, where the white spots had been previously noticed. A thin grey layer presenting a somewhat irregular surface remains on the choroid, after the retina has been carefully removed. This layer varies in thickness, and is at places entirely absent; the corresponding parts of the retina present similar irregularities; where the layer adhering to the choroid is thick, the outer layer of the retina appears to be defective, and *vice versa*. In fact, it is found on microscopical examination, that portions of the columnar layer of the retina have remained with the choroid, and that consequently the retina appears defective. This thin greyish layer on the inner surface of the choroid consists chiefly of a tolerably soft, somewhat jelly-like fragile substance, which under the microscope appears homogeneous, presenting at the utmost a faintly granular appearance at places. The thickness of this substance, partially uniting the retina and choroid, is everywhere but slight. Microscopically, it has quite the appearance of a fluid effusion between the retina and choroid, that has been coagulated by the use of a solution of chromate of potash.* I have had repeated opportunities of examining various stages of this process of coagulation in diseased eyes, and am convinced that fluid exudations in the interior of the eye, which always contain a large quantity of albuminates, coagulate in a peculiar jelly-like way, by the gradual action of a solution of chromate of potash, especially when the eye is hardened before being opened. The substance keeps most of its transparency, becomes jelly-like, resembling thin coagulated glue, though more easily disintegrated into separate particles by slight pressure. Longer action of the reagent causes a steady increase of the hardness; the translucency, however, persists. Under the microscope it appears homogeneous

* Remark. In a notice of this case ("Sitzungsbericht der ophth. Gesellschaft, Zehender's Monatsblatt, vi, p. 299), this effect is erroneously attributed to carbonate instead of chromate of potash.

or only very delicately and faintly granular. Sometimes lymph-corpuscles, delicate threads of fibrin, &c., are included in it; more often it contains no formed elements. From this agreement of the physical condition and of the appearance under the microscope, it seems to me very probable that we have had here a little fluid effused between the retina and choroid, and that this has become a jelly through the action of the reagent. That it is not due to post-mortem change is shown by similar states being never found in normal eyes treated by chromate of potash, whilst they are very common in cases where enucleation has been performed for threatening or commencing sympathetic disease of the other eye. We find in such eyes, which are usually affected with chronic irido-cyclitis or infiltration of the vitreous, thin layers of a similar jelly-like coagulated matter, between the retina and choroid, or between the latter and the sclera; I have, indeed, often found the contents of the anterior or posterior chamber likewise coagulated, in cases besides, where during life they were certainly fluid in the anterior chamber. Sometimes there were at other places extensive separations of the retina or choroid, and the corresponding fluid was affected in the same way by the reagent. Of course, previous hardening of the eye is in such cases indispensable, for the purpose of proving the existence of very small quantities of fluid exudation; on opening the fresh eye this would be quite impossible, owing to the instant escape and great collapse; it is indeed, decidedly difficult to prove the existence of a large retinal separation by opening a fresh eye. Very small effusions are thus kept in their place by coagulation; the abnormal amount of albuminates, and hence their inflammatory origin,* is proved by the very fact of their coagulating. The negative result of ophthalmoscopic examination in our case proves that during life there was certainly neither a coagulated substance nor any consistent

* I may remark, that peculiar vacuoles, round, elliptical, or elongated in one direction, varying much in size, are observed in such coagulated fluids under the microscope. At first sight they have a very peculiar appearance, and might occasion errors. I conclude that they are due to coagulation, because I once observed similar appearances in a thin layer of coagulated size from one of the larger vessels into which it had been injected. The substance causing coagulation is an alkaline albuminate, for it not only coagulates by boiling, or by nitric acid, but also by acetic acid. Its percentage is often so great, that, after coagulating, the fluid becomes perfectly solid, and the glass can be turned upside down without a drop falling. Acetic acid in excess causes only partial solution, the mass becoming translucent and swollen, and a part also apparently dissolving. Fluid from the vitreous space in cases of *synchysis vitrei* was affected by chromate of potash exactly like that effused between the membranes, and was, therefore, probably also due to inflammatory exudation. I once examined the fluid from a retinal separation, after the eye had been for a short time only in chromate of potash; it was already coloured yellow, though not coagulated; acetic acid caused firm coagulation. Frerichs long ago showed that there was a large quantity (3·7 per cent.) of soda-albuminate in the fluid vitreous of a dog's eye.

exudation; had anything of the kind existed, the choroid would certainly not have appeared normal, it would at least have seemed in some degree clouded or veiled. It is quite conceivable, that a little serous fluid was effused between the two membranes, yet not enough to displace the retina so far that any change could be perceived in the position of the vessels. The only remaining alternative is that of a post-mortem change; to the objections already made I may add that the parts of the retina concerned presented but very slight post-mortem alterations; even the rods, which are almost always more or less altered in eyes that are not placed immediately after death in the hardening fluid were here in a very good state; the boundary line between their outer and inner portions could be most distinctly seen; the ends alone of the outer portions showed commencing post-mortem change in the form of little bulbous swellings. The elements of the rod-layer were obviously protected and kept in their place by the jelly-like coagulated fluid; the rods generally fell off when we separated the other parts of the retina, so that vertical sections could not be obtained with a perfect columnar layer. Such sections could, however, be admirably effected at the diseased spots, and it was now found that they showed *a very remarkable change of the retina itself*. The rod-layer was not, as usually, immediately applied to the other layers, but was separated from the external granular stratum by various thicknesses of the same substance which covered its outer surface, between it and the choroidal epithelium. This substance had the same characters as that between the choroid and retina; we must, therefore, admit that during life the columnar layer was separated *in toto* over a certain space from the remainder of the retina by a fluid exudation.

The separation not being everywhere equally great, the rod-layer was raised into continuous, closely applied folds. A section, therefore, had a very wave-like appearance, the elevations and depressions being sometimes tolerably steep, sometimes more gradual. The greatest distance of the base of the rods from the outer granular layer was equal to twice the height of the columnar layer itself; the latter at the bottom of the folds sometimes touched the outer granular layer, sometimes was at a very little distance from it. In somewhat coarser specimens, a vertically divided fold of the separated rod-layer was often noticed so rotated, that its two sides (*Blätter*), instead of being on, were over, or by the side of, one another; thus above the normally placed row of rods, separated by a layer of the exudation so often mentioned, there was a second row, with its elements upside down, so that the outer portions were turned to the outer portions of the other row, as may be seen in Fig. 5, plate 2. Of course this is simply an effect of the section. We notice also pieces of the rod-layer, apparently more or less connected with

the inner layers, in the intermediate space containing the delicately granular coagulated mass; at one point, where a separation was just commencing, the fibre of a bulb seemed yet entire, running through the finely granular matter. There were besides in the intermediate space, some round, delicately granular bodies, without any distinct nucleus; it was doubtful whether these were round cells, or, what seemed more probable to me, separated and altered bulbs. I am the more inclined to take this view, because no analogous elements could be found in the fluid between the choroid and retina.

We have already mentioned, that the bulbs, and especially the rods, were in good condition where separation had taken place. The other layers of the retina showed no change. The *choroidal epithelium* was perfectly normal, the pigmentation everywhere uniform, and tolerably dark; it was unchanged under the coagulated exudation. The *stroma of the choroid* appeared normal to the unaided eye; the microscope, however, showed changes that indicated an inflammatory process. The cells, resembling lymph-corpuscles, in the stratum of small vessels, were decidedly increased in number, and formed here and there small heaps and collections, which became very distinct after the use of carmine, and then could be recognised by the naked eye. The cells of the stroma, both those containing and those without pigment, presented abnormal appearances. Many of them contained two or more nuclei; in the latter case the nuclei were often scattered in various parts of a large cell, and it was then very difficult sometimes to decide whether there was one large cell with two divisions, or two cells connected by a broad extension. Most of the cells were tolerably large and oval; they usually became distinct only after the use of carmine, so that without this means many of them would have been easily overlooked.

These changes make it at least probable, that the fluid between the choroid and retina, and between the layers of the latter, arose from an inflammatory process in the choroid. The history favours this view, the patient having suffered from an ophthalmia, of what kind could not indeed be afterwards determined, four weeks before his admission. A retinal origin must be rejected, as no trace of inflammation could be found in that membrane.

The *optic disc* was normal; there was no *excavation*, but only a little central depression where the vessels emerge. The intra-ocular end of the nerve was found to be quite normal by microscopical examination. There was a partial fatty disintegration of the bundles of nerve-fibres in the orbital portion of the nerve, of which a piece, a few mm. long, had been removed with the eye. The bundles of nerve-fibres were closely studded with small and large fatty granules; the longitudinal striation was thus rendered very indistinct. The greater part, however, of the section did not present this change. The sheath and connective-tissue framework

of the nerve were normal; there were no fatty granular cells. In this respect our case differs from the one recorded by Erismann,* where Eberth found great thickening of the connective-tissue trabeculae supporting the vessels, atrophy and finely granular disintegration of the nerve-fibres, and granular cells in the atrophied nerve-bundles, whilst in our case there was only the infiltration of the nerve-bundles with fine fatty globules. (Erismann's case was that of a great drunkard, who was nearly blind, fingers to 1', somewhat pale anæmic disc, field of vision previously normal, could not be examined towards the end.)

Microscopical examination showed in our case no anomaly of the remaining tissues of the eye.

Critical Remarks.—The amblyopia observed during life may, *à priori*, be just as well attributed to the disease of the retina as to that of the optic nerve; the question is, how far did it depend on the one, and how far on the other. The disease of the optic nerve may be justly attributed to chronic poisoning with alcohol, especially if we take into consideration Erismann's case. It very probably caused the moderate impairment of central vision in our case, and its slight degree will quite account for the differences in the anatomical state and the absence of certain changes that were found in Erismann's case. It appeared from the history, that the patient had been suffering for many years from increasing amblyopia, attributable, as already mentioned, to the abuse of spirituous liquors, and anatomically depending on an affection of the optic nerve. We are obliged to come to this conclusion, principally because simple amblyopia potatorum is not attended with any contraction of the field of vision, unless the optic nerve is beginning to atrophy, which was not the case in our patient. The increased amblyopia after the temporary inflammation, with indistinctness of excentric vision and great torpor retinae, must undoubtedly be referred to the retinal change, the position of the anomaly in the field of vision (at the inner side) also agreeing with that of the retinal disease (at the outer side). To the objection that in the common amblyopia of drunkards the changes are not so palpable as in this patient, and that the disease of the optic nerve must have been attended by some interference with the field of vision, we must reply that the state of the optic nerve in this disease has hitherto been determined in Erismann's case alone, where towards the end the field could not be examined. The appearance of numerous fat granules in the nerve-bundles does not by itself justify the assumption that the nerve-fibres are completely disintegrated. It is quite conceivable that the axis cylinder may exist and conduct; we find, indeed, at a certain stage of regeneration after section of a nerve, that fibres, which have by no means a perfectly normal appearance, are able to conduct. The

* Erismann, über Intoxicationsamblyopien, Inaug. Diss., Zürich, 1867, p. 54, &c.

indistinctness of excentric vision must therefore be attributed to the slight separation of the retina and of the columnar layer; the torpor in the affected part of the field quite" agrees with what is found in ordinary cases of separated retina.

What chiefly interested me, whilst the patient was alive, was the continuance of distinct glaucomatous tension, with a corresponding reaction on the pupil, a shallow chamber, and impaired vision, without a trace of excavation. The choroido-retinal process was clearly the cause of at least the great part of the amblyopia, and in respect to its relation to the tension only three suppositions are possible: (1) the two processes were independent of one another, and the functions of the retina were unaffected by the tension; (2) the glaucoma was secondary to the choroido-retinal process, and had not yet re-acted on the disc; (3) the tension was the primary affection, the choroido-retinal process secondary. None of these suppositions can be decidedly contradicted or proved, though in my opinion the last is the most probable. The form of the choroido-retinal lesion is very peculiar, so that on that account we are inclined to assign it to a special cause; a continued increase of tension would serve excellently for such, as it would necessarily impede the venous circulation, and hence cause a tendency to œdema or serous choroidal effusions. It is besides much more likely that the pressure pre-existed, and that the other lesion has but recently occurred, perhaps when the sight became more rapidly worse, because the tension was unusually steady, and such a great degree, apart from glaucomatous inflammation—such was certainly not the recent inflammation, for the vision decreased not *during* it, but after its termination—is usually developed very gradually. However that may be, that increased tension may cause such effusions is rendered probable by this case; we certainly should keep the possibility in view, for in many patients we can scarcely refer the functional state to interrupted nervous communication at the edge of the disc, apart from the fact that the excavation is sometimes very moderate.

Just as from individual anatomical causes, excavation is sometimes produced with great ease, when the tension is relatively little increased and unattended by its usual reaction on the size of the pupil, the depth of the anterior chamber, &c., so also may its formation be impeded by previous organic conditions, and other consequences be first produced in the interior of the eye. Perhaps it will be found by further anatomical researches—necessarily so, if the preceding suppositions are correct—that excavation of the disc is indeed by far the most constant index of a continued increase of tension, yet that in a certain number of cases various changes of the inner membranes, similar to the one described, co-exist with it. Lastly, the clinical fact, that lesions of the choroid and retina appear long after iridectomy and point to a previously

latent process, would favour our view, it being supposed that similar cases will occasionally reappear (I can at present add only a solitary case of the kind).

As to the treatment, I have no hesitation in recommending iridectomy, where with decreasing vision the tension proves on palpation to be decidedly increased, though the excavation is not characteristic. In some of the cases already mentioned, of old people, in whom, apart from the form of the excavation, the exquisitely sharp limitation of the defect in the visual field caused me to doubt the interrupted nervous conduction at the edge of the disc, a very satisfactory result, preservation of the *status quo*, or gradual improvement, was obtained from iridectomy, or from the consequent diminution in the tension.

The Operation for Glaucoma.—I shall conclude with some remarks on this subject. I mentioned at the commencement of this essay, that the rule to excise a large piece of iris up to the periphery is not of equal value in all cases. I consider it of great importance for our object, and it has a certain, though limited, relation to the older rule, that the iris should be carefully and completely removed from the wound, *for any inclusion of it in the cicatrix will certainly increase the secretory irritability of the eye.* Had I to choose between a coloboma that does not reach quite to the periphery, but in which the iris is free, and one perfectly peripheral, but in which one edge of the coloboma is largely included in the cicatrix, I should always prefer the former. The more peripheral the internal wound, the greater is the risk of including the iris. That an inaccurately performed operation will generally answer in very acute glaucoma, may be partly owing to the operator fearing in such a case to make a strictly peripheral wound, and thus more easily avoiding adhesion of the iris. It is necessary to make the internal wound sufficiently long, in order that, with a large spontaneous prolapse, the iris may be excised without any excessive traction up to the periphery. I am more and more inclined to advise the operator himself to excise the iris, especially when he is not perfectly accustomed to his assistant. The latter, however skilful, can scarcely apply the convexity of the scissors so exactly to the edges of the wound, or even within the wound itself, as the operator, who, using both hands, feels the tension of the iris. Not only must we take care not to leave a peripheral zone of iris (more than the unavoidable minimum) in the very act of excision—the latter need not, owing to the shortness of the wound, be *à plusieurs temps*, as in the operation for cataract—but we must also remember that one or other edge of the coloboma may be included in the angle of the wound. That this is the case, is shown by the corresponding side of the coloboma being not sufficiently long, and the angle of the sphincter being somewhat approximated to the wound. We must then act just as in the operation for cataract. Re-position

may be effected by stroking the eye with the convexity of the caoutchouc spoon, and the same proceeding will serve to cleanse the wound of any small flakes of pigment. Should there still remain any shortening of one edge of the coloboma, a fold of iris is included in the angle of the wound, and must be excised. If blood in the anterior chamber impedes our view, the lids should be closed and gently compressed with a sponge dipped in iced water; the hæmorrhage will stop in a few minutes, and the blood will escape, at all events sufficiently, if the wound is made to gape and the globe is gently compressed. *In no case should the operation be concluded till we are certain that the iris is completely released from the wound.* The prevention of *posterior* synechiæ, though of secondary importance, should also be attempted. The tendency to their formation may be generally recognized immediately after the operation, by a projection of the angles of the sphincter. When this is the state, I usually let atropine be applied a few times on the day after the operation; in other cases I do not commence with its regular use till the third day (excluding the cases in which the eyes continue excessively tense and threaten a malignant course).

Besides the stricter recognition of these principles, and the more exact indications in the various forms of secondary glaucoma, I consider the diametrically opposite iridectomy an important advance in the treatment. No progress of importance has been made in respect to the *theory* of the operation, notwithstanding many attempts. Old hypotheses are usually dragged forth, little as they avail for the explanation of existing facts. The unhappiest of all, the one referring the effect simply to the wound of the ocular capsule, is periodically brought forward, decked in some new formula, and recommended for adoption. Fortunately for our patients, practice advances independently on the foundation of empirical principles. No doubt, some day a satisfactory theory will be found, but in the meantime we must not be led away by transient hypotheses.